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Efficient Regional Allocation of Farm Products and Programmed Supply Prices

By Earl O. Heac Alvin C. Egbert

Information on efficient regional patterns of agricultural production can be useful in devising policies for adjustments in farming that are consistent with modern conditions and concepts of economic development. Such knowledge can also indicate the amount and location of land to be withdrawn from production if surpluses and related treasury costs are to be reduced. If long-run solutions to the "farm problem" are to be attained, the Nation needs data indicating the number and location of crop acreages and outputs under a variety of situations. This information can be made available only by analysis of relationships among regions. In this paper the writers discuss the application of relatively simple linear programming models to the specification of efficient interregional allocation of agricultural production. A more detailed discussion appeared in a recent report of cooperative research with Iowa, U.S. Department of Agriculture Technical Bulletin 1294, *Regional Analysis of Production Adjustments in the Major Field Crops: Historical and Prospective* (November 1963).

AMERICAN agriculture has operated under production control policies for three decades. In general, farm programs use historical acreage patterns as a basis for income transfers or compensation. Direct subsidy payments, and indirect payments in the form of commodity support prices that are higher than market prices, have kept production in various regions from adjusting as much as would be consistent with changes in factor prices, commodity prices, and technology. Farmers can collect direct and indirect subsidies only if they reduce planted acreage by specified proportions. Ordinarily these proportions are the same for all farmers and regions. Interregional allocations of production are accordingly tied more to historical economic structure than to existing resource conditions.

Further, it is likely that orthodox production policies have forced production patterns that are inconsistent with recent developments in technology and prices. For example, a farm program may require a producer to reduce acreage of a "surplus" crop such as wheat, cotton, tobacco, or corn, but allow him to use the "withdrawn" inputs of land for a substitute crop not normally grown in the region or not classed as "surplus." Thus, farmers in wheat regions are required to reduce acreage of wheat, but may plant soybeans, grain sorghums, or other feed grains. Corn Belt farmers have been required to reduce acreage planted to corn, but allowed to substitute soybeans, sorghums, or other feed grains and even small amounts of wheat. Farmers in cotton areas have been required, in numerous recent periods, to reduce land in cotton but have been allowed to replace it with corn or other field crops. Consequently, the pattern of production spread among the many specific agricultural regions not only is tied to technologies and prices of earlier decades but may be incongruent with current production possibilities and demand conditions. We have little knowledge of the shifts which would take place if the Nation were to pursue a policy of the most efficient interregional allocation of agricultural production.

Regions and Models Used

For the analysis, we used the 122 numbered areas shown in figure 1.[1] In delineating these regions, we attempted to fix the boundaries so that soil and production practices would be reasonably uniform within each region. Thus, production costs for farms within each region would tend to be the same. If production costs for all farms within a region were identical, perfect delineation would be achieved; and we would have an ideal programming situation. The boundaries were chosen to realize this goal as closely as possible.

A programming model was used to determine the optimal acreage and output of each crop in each region. We also determined the acreage to be withdrawn from these crops in each region,

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[1] The large white areas without numbers in figure 1 were not included in the programming model because they produce only small amounts of crops and do not respond to price changes for these crops.

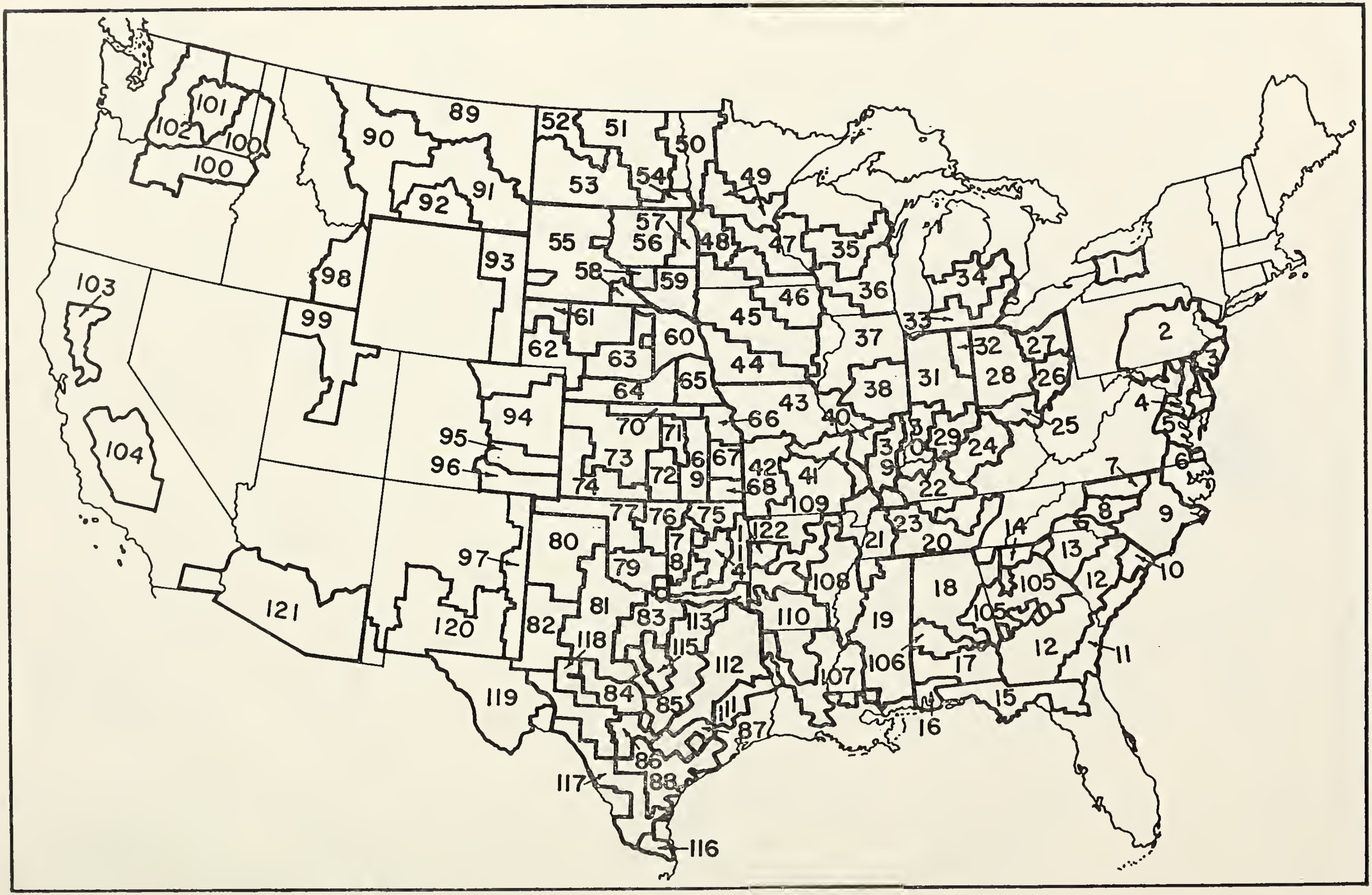


FIGURE 1.—*The 122 programming regions.*

if production is specified to be exactly equal to "normal" domestic and export requirements. Thus, demand is specified as a "fixed bill of goods." Although we did not use continuous demand functions explicitly in programming, we did base the requirements or "the fixed bill of goods" on projections of population, income, and demand relationships and also on product prices which were expected to be near the supply prices that are obtained from the programming solution. Other regional analysis results provided a guide for setting these product prices.

The model underlying the results presented can be summarized as follows:

x_{ij}=level of the jth crop activity in the ith region.
a_{ij}=land input required per unit of the jth activity in the ith region.
b_{ij}=primary output per unit of the jth commodity in the ith region.
b'_{ij}=secondary output per unit of the jth commodity in the ith region.
c_{ij}=cost per unit (including an estimate of average transfer cost) of the jth activity in the ith region (land rents not included in costs).
s_i=land restraint in the ith region.
d_k=national restraint for the kth commodity.
($i=1, 2, \ldots, 122$)
($j=1, 2, \ldots, 6$)
($k=1, 2, 3, 4$)

The objective is

$$\text{(1)} \qquad \text{Min } f(x)=\sum_i \sum_j c_{ij}x_{ij}$$

when each activity is subject to a regional land constraint

$$\text{(2)} \qquad \sum_i a_{ij}x_{ij} \leq s_i$$

and to the national demand restraints

$$\text{(3)} \qquad \sum_i b_{i1}x_{i1}=d_1,$$

$$\text{(4)} \qquad \sum_i \sum_{j=2}^{4} b_{ij}x_{ij} \leq d'_2,$$

$$\text{(5)} \qquad \sum_i \sum_{j=4}^{6} b'_{ij}x_{ij} \geq d_3,$$

$$\text{(6)} \qquad \sum b_{i5}x_{i5}=d_4,$$

and

$$\text{(7)} \qquad \Pi\Big(d_3-\sum_i \sum_{j=4}^{6} b'_{ij}x_{ij}\Big)+\Big(d'_2-\sum_i \sum_{j=2}^{4} b_{ij}x_{ij}\Big)=0$$

For production,

$j=1$ is wheat for food.
$j=2$ is wheat for livestock feed.
$j=3$ is grains (corn, oats, barley, grain sorghum) for livestock feed.
$j=4$ is soybeans grown in combination with feed grains.
$j=5$ is cotton.
$j=6$ is soybeans grown alone or independently.

For demand,

$k=1$ is food wheat.
$k=2$ is feed grains (feed wheat is aggregated with other feed grains).
$k=3$ is oilmeal from soybeans and cottonseed.
$k=4$ is cotton.

The quantity

b_{ij} is for wheat, feed grains, and cotton lint, which move directly to consumption in meeting the national requirement.
b'_{ij} refers to oilmeal and cottonseed meal for livestock feed ($b'_{ij}=r_jb_{ij}$ where r is the extraction rate of meal), and is only a part of the primary output (soybean oil, cottonseed oil and related cotton products were not considered in the demand restraints).

The demand restraint in (7) is used to allow substitution of feed grains (low protein feeds) for oilmeals (high protein feeds) and vice versa when one or the other is cheaper per feed unit. However, we use only a constant substitution rate, Π, and allow substitution only up to a maximum national input of feed grains and down to a minimum national input of oilmeal (wheat was allowed as a feed grain, and protein content of feed grains and carbohydrate value of soybean and cottonseed meals were taken into account for setting substitution rates). Hence, d'_2 is the upper bound on feed grain requirements and d_3 is the lower bound on oilmeal requirements. Within these restraints, (a) feed grain and oilmeal crops can be substituted in primary crop production and (b) feed grains and oilmeals can be substituted in livestock rations, to minimize the cost of these feeds in producing livestock.

Adequacy of Programming Models

Conceptually, several methods are available for analyzing the allocation of resources spatially or interregionally. At one extreme, one might estimate supply and other appropriate relationships for a sample of farms in each region. These relationships might be estimated normatively through parametric programming.[2] Then, after derivation of supply functions for the individual firms, these can be weighted appropriately for each domain or stratum, and aggregated to provide totals for the various regions.[3]

However, this approach usually involves a prohibitive number of computations when an adequate number of regions is used, especially in assembling restraints and coefficients for individual firms. Moreover, this approach produces great aggregation problems, not only in determining appropriate weights for aggregating firm supply functions but also in handling ceteris paribus assumptions. For example, at the firm level prices of some alternative products and the prices of many factors can be treated as exogenous variables. This is not true for the firms in aggregate. Thus, aggregated firm supply functions can have serious limitations.

At the other extreme, entire regions can be used as producing units or "firms" under specific assumptions or conditions. These assumptions can never be fully met. However, it is possible that results which consider the region as the producing entity are sufficiently parallel to those based on a firm approach to serve as a basis for policy. Our experience with such models, as well as theory and logic, leads us to believe this is true.

In this analysis, as indicated by the formal model, we do not estimate positive supply functions by commodities and regions. Instead, we simply compute the multiregional pattern of production, given land restraints by regions and particular objective functions. The pattern obtained by using regions as producing units is approximately the same as that which would result from using regionally identified farms if farms are structured and if farmers' production response is as depicted by the following formal conditions:

The production function for the ith farm and jth product of each region must be

$$\lambda y_{ij}=f_{ij}(\lambda x_{ij1}, \lambda x_{ij2}, x_{ijk} \ . \ . \ . \ \lambda x_{ijm}) \tag{8}$$

where x_{ijk} is input of the kth factor ($k=1, 2, \ldots, m$) so that constant returns to scale exist. Hence,

$$Y_{ij}=a_{ij}x_{ij1} \tag{9}$$

since

$$x_{ij1}=g_{ijk}(x_{ijk}) \text{ for } k_1 \tag{10}$$

a_{ij} in equation (9) is equal to the total derivative of Y_{ij} with respect to the x_{ijk}'s and x_{ij1} refers to land. Then the marginal cost or supply curve for any farm i and product j is given by equation (11):

$$\frac{P_{ij}}{a_{ij}}=MC_{ij} \text{ or } P_{ij}=k_{ij} \tag{11}$$

with the side condition $Y_{ij}r_{ij} \leq B_i$, in which MC_{ij} represents the marginal cost of Y_{ij}, r_{ij} is the land required per unit of Y_{ij}, B_i is the number of acres on the ith farm, and P_{ij} is the price of the bundle of resources as given by function (12).

$$P_{ij}=P_{xij1}+P_{xij2}, G_{ij2}(X_{ij2})+P_{xij3}, G_{ij3}(X_{ij3})+ \ . \ . \ . \ +P_{xijp}, G_{ijp}(X_{ijp}). \tag{12}$$

If the above conditions are fulfilled and furthermore,

$$\frac{P_{1j}}{a_{1j}}=\frac{P_{2j}}{a_{2j}}=\frac{P_{3j}}{a_{3j}}= \ . \ . \ . \ =\frac{P_{nj}}{a_{nj}} \tag{13}$$

i.e., $k_{1j}=k_{2j}= \ldots =k_{nj}$, then within a region the supply curves for products are the same for all farms. This is true even though farms may have different resource organizations and constraints. Therefore, the regional supply functions are given by

---

[2] Generally, we do not believe that regional regression models are realistic, (a) because of a lack of data for a sufficient number of regions and (b) because they are based on historical observations without allowing for possible technological and structural changes.

[3] An example of this approach is presented in a forthcoming Iowa report by Jay C. Anderson and Earl O. Heady, *Normative Supply Functions for Milk and Agricultural Adjustment Possibilities in Northeast Iowa.*

$$P_1 = K_1 \\ P_2 = K_2 \\ \cdot \quad \cdot \\ \cdot \quad \cdot \\ \cdot \quad \cdot \\ P_j = K_j \\ \cdot \quad \cdot \\ \cdot \quad \cdot \\ \cdot \quad \cdot \\ P_m = K_m \tag{14}$$

and the regional side condition is

$$Y_j b_j \leq B \text{ for all } j. \tag{15}$$

If these conditions are satisfied then

$$F_j = \sum_{i=1}^{r} f_{ij} \tag{16}$$

and

$$X_k = \sum_i \sum_j X_{ijk}. \tag{17}$$

Hence, aggregate production is equal to the sum of production by farms and total resource use is equal to the sum of resource use by farms.

The above formulations take the long-run viewpoint in which all factors except land are considered as variable. And this is the viewpoint we take in this report. We attempt to specify regional production efficiency from the long-run or full adjustment of resources position. For many purposes it may be desirable to analyze regional adjustments over a shorter period of time in which resources in addition to land are fixed. In this case, the programming problem is more complex; not only from the standpoint of specifying more resource constraints, but also from the standpoint of specifying regions and programming activities. We can no longer assume that resources which go along with land use will be available at the desired levels and in the correct proportions. Even though fixed resources do not need to be the same on all farms for a short-run regional programming model, they do need to be proportional. If this is not the case, condition (16) will not be satisfied; regional output will not be the sum of the output of farms.

We are concerned with long-run efficiency and not short-run problems in this paper. We know that because assumptions (8) through (15) are not completely satisfied in our empirical demarcations of regions, the analysis may be limited. However, the results of numerous analyses suggest that long-run regional programming models do give answers that provide diagnostic indications of disequilibrium among regions in American agriculture.

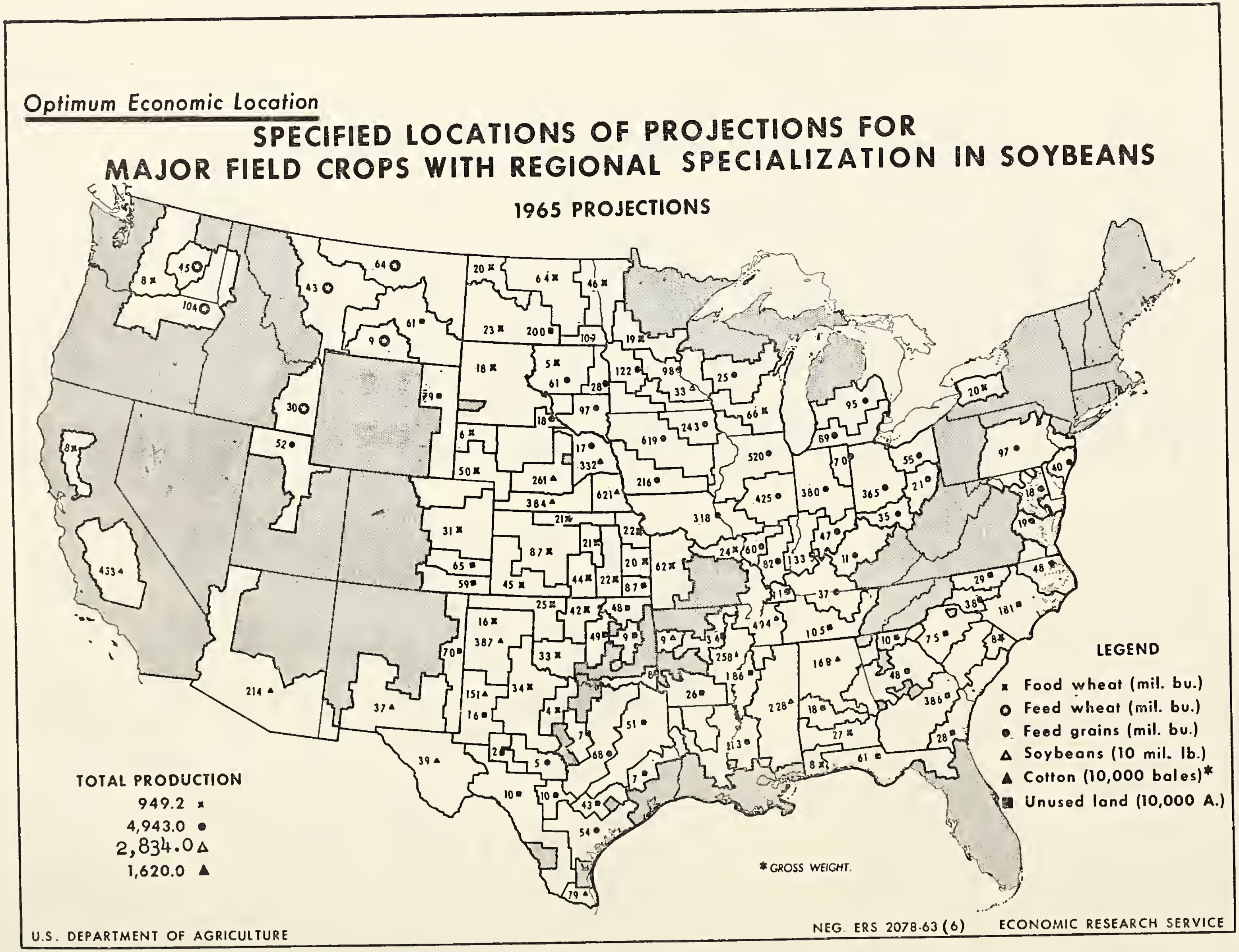
Quantitative Results

Results are summarized by regions in figure 2. On the basis of these results, some land now used for producing food wheat in Washington, Oregon, and Montana would be devoted to producing wheat for livestock feed. However, the outcome might have been different if we had specified national wheat requirements by classes. Because we allowed a single soybean activity, production of this soybean oilmeal becomes concentrated in regions such as eastern Nebraska and southern Illinois where soybeans have a favorable yield relative to feed grains. With free markets, specialization would be likely to move in this direction but probably not as far as indicated if crop rotational requirements were considered. (In models which tied soybeans to feed grain rotations, somewhat different results were obtained.)

Cotton production would move out of the Southeast and become concentrated in the Southwest, with soybeans partially replacing the former in some cotton regions. (Again, consideration of some rotation restrictions provides results with a moderately different production pattern.) The Southwest would lessen feed production to specialize in cotton. Large areas of the South and Southeast would be withdrawn from any of these crops and, in the realm of feasible production possibilities, would need to be shifted to grass, forestry, recreation, etc.[4] Adoption of improved technology might, however, allow the South and Southeast to become competitive for some feed grains. (Analyses underway suggest this possibility.)

---

[4] Present production techniques were used to define activity costs, except that fertilizer use was allowed to increase to the level at which the estimated marginal value of product per acre is equal only to twice the cost of the fertilizer input. (In general, farmers use amounts of fertilizer giving a marginal value product more than twice as great as the marginal cost.)



Optimum Economic Location

SPECIFIED LOCATIONS OF PROJECTIONS FOR MAJOR FIELD CROPS WITH REGIONAL SPECIALIZATION IN SOYBEANS

1965 PROJECTIONS

LEGEND

- ✖ Food wheat (mil. bu.)
- ○ Feed wheat (mil. bu.)
- ● Feed grains (mil. bu.)
- △ Soybeans (10 mil. lb.)
- ▲ Cotton (10,000 bales)*
- ■ Unused land (10,000 A.)

TOTAL PRODUCTION

949.2 ✖
4,943.0 ●
2,834.0 △
1,620.0 ▲

* GROSS WEIGHT.

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FIGURE 2

Some land also would be withdrawn from field crop production (wheat and feed grains) in marginal areas of Montana, Wyoming, southeastern Colorado, eastern New Mexico, and scattered areas of Oklahoma and Texas. Generally, this land would transfer to less intensive uses such as grazing.

The demand or requirement restraints shown in figure 2 are based on 1965 projections of population, income, demand relations, and exports. Under these figures, the model solution gives rise to the land requirements in table 1. The total land base used for programming was 255.8 million acres. It represents the maximum acreage historically used for specified crops. This base did not include (a) acreage in excluded regions (fig. 1), (b) acreage devoted to other field crops, or (c) land unsuited for the particular crops. Of this 255.8-million-acre base, a total of 25.3 million acres could be withdrawn from production of the crops considered and converted to other purposes. This figure includes only land not required for the specified crops, and excludes land in other crops which might be "surplus." However, surplus land comes dominantly from the above crops. Furthermore, our figures might be conservative considering adoption of new technology.

TABLE 1.—*National acreages specified by solution of the model*

Crop	Acres (million)
Wheat	97. 6
Corn	77. 5
Oats	16. 7
Barley	2. 3
Sorghums	3. 3
Soybeans	20. 2
Cotton	12. 9
Unused land	25. 3
Total land	255. 8

The quantitative results suggest how the concentration of agricultural production might be altered by regions if (a) production were spaced most efficiently over the Nation and (b) surplus production were eliminated. The pattern depicted, one which might be brought about by specific policies, by market means, or by combinations of the two, would concentrate shifts in particular geographical locations. This type of adjustment is in contrast with those used in the past where a small proportion of land has been withdrawn from production in all regions without regard to, and sometimes in conflict with, changes in relative advantage of various regions. Programs designed to bring about interregional shifts consistent with relative changes in prices and production possibilities would need to compensate farmers in regions where large acreages are diverted. Similarly, direct compensation might be required for nonfarm families in rural communities as the resultant decline in farm population would decrease the demand for products and services supplied by towns and villages.

Programmed Supply Prices

The results of the model give rise to national average supply prices for each crop considered. These are presented in table 2 to show the price structures that arise from the regional production patterns shown in figure 2. These prices represent average marginal costs (supply prices) derived in programming solutions. They include all costs, except those for land, with all labor priced at market wage rates. Because regional differences are inherent in the model, imputed prices in individual regions deviate from the national averages.

The first column of prices is for the basic analysis described above. Prices for an alternative analysis are presented in the other column. In the latter analysis, activity x_6, soybeans grown alone, is not included; only the feed grain rotation with soybeans is included, together with the other feed grain, wheat, and cotton activities. As compared with the basic analysis, the alternative does not lead to a concentration of soybean production in regions such as eastern Nebraska. Accordingly, the analysis develops a production pattern that requires a little more land.

TABLE 2.—*National average supply prices*

Crop	Basic analysis'	Alternative analysis
Wheat (bu.)	$1. 21	$1. 33
Corn (bu.)	. 95	1. 09
Soybeans (bu.)	1. 35	2. 10
Cottonseed (ton)	28. 26	39. 15
Cotton (G.W. bale)	98. 10	95. 31

The programmed supply prices, in both the basic and alternative models, are somewhat higher than the prices which were used in establishing demand quantities for the "national bill of goods."[5] Hence, under projected equilibrium, the supply prices would be slightly higher than those in table 2. Moreover, the supply quantities would be slightly lower than those used as programming restraints.

The use of straight soybean activities in the basic model generates large changes in the cropping pattern and supply prices and illustrates interdependency in crop quantities and costs. As shown by table 2, all marginal costs (prices), except cotton, for the basic analysis are considerably lower than those for the alternative model. Prices are lower because soybeans and feed grains are produced singly in areas where they have the absolute or comparative advantage. Or, in other words, feed grains and soybeans are produced separately in the regions when such production reduces total cost for the collective overall model.

With the added degree of specialization permitted in the basic analysis, the land base used for soybeans and feed grains shrinks. Consequently, land is released for other uses. The released land is more productive for wheat than some of the areas used for wheat in the solution of the alternative analysis. Hence, when this land is used for wheat production in the basic model, the supply price of wheat also declines.

Soybean oilmeal and cottonseed oilmeal are substitutes in livestock rations and their prices are interrelated, so the reduction in supply price of soybean oilmeal also causes the price of cottonseed oilmeal to decline. To compensate for the lower price of oilmeal, which is a joint product with cotton lint, the average national (programmed) supply price of cotton is somewhat higher under the basic model than under the alternative model.

Cost Reductions From Land in Alternative Uses

Table 3 presents the the shadow prices of land derived for the basic analysis in the 122 production regions. These prices are in italic type in the table. (Other numbers in the table that are not italicized will be explained shortly.) Shadow prices represent, for cost minimization models, the marginal savings to be realized if one more unit of the resource could be used in a particular way. For example, the $6.76 listed in table 3 under food wheat for region 1 can be interpreted this way: If one more acre of land were available for food wheat production in region 1, total production cost for the Nation would be reduced by $6.76. This additional output from region 1 would replace wheat production in some other region where the production cost is higher (a marginal region); hence, there is a saving in cost of $6.76 as an acre in region 1 is substituted for an acre in another region.

Because of the unique nature of the regional analysis presented in this report, the shadow prices can be given yet another interpretation. The models simulate purely competitive economic structures. Hence, the marginal costs (supply prices) can be considered as approximations of market prices, given the qualifications mentioned earlier concerning demand prices and quantities. With the relevant regional prices, we can compute the shadow prices for each region. To do this, we multiply the regional price by the output of the activity which was selected in the production program and then subtract from this product the cost per acre of the activity. For wheat production in region 1 this figure is $6.76. Thus, the shadow prices obtained as the dual to the programming problem are equivalent to the net returns per acre that would be realized, given the derived average supply prices (table 2). This net return can be considered as the imputed return to land when used to produce the crop specified in the programming solution.

Once the equilibrium prices are derived from the programming solution, the imputed earnings of alternative activities (those not included in the programming solution) in each region can be computed similarly. These computations were made, given the programming solution for the basic analysis. The alternative earnings for activities not in the programming solution are those not in italics in table 3.

Expected earnings of alternative enterprises can be positive or negative. Thus, if wheat were produced and sold for feed in region 1, the expected earnings per acre would be $1.51. But if

---

[5] The "national bill of goods" includes 949.2 million bushels of wheat, 4,807.5 to 4,943.0 million bushels of corn (feed grain with the range allowed for substitution by oilmeals), 14.2 to 16.5 million tons of oilmeal and 16.2 million G.W. bales of cotton. In addition to these quantities, the amounts produced in the nonprogrammed areas of figure 1 have been subtracted from national requirements. Seed requirements were subtracted from gross yield in calculating "net" outputs per unit or acre, the b_{ij}.

Table 3.—*Alternative net earnings per acre from the production of specified crops, and crop rotations at prices implied by the solution to the basic model*

Region	Food wheat	Feed wheat	Feed grains	Feed grains and soybeans	Soybeans	Cotton
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
1	*6. 76*	1. 51	−3. 03			
2	−1. 77	−5. 08	*5. 55*			
3	−6. 49	−11. 67	11. 08	−8. 56		
4	−6. 46	−11. 04	*8. 67*	*3. 08*	−10. 95	
5	6. 93	1. 74	*9. 29*	−4. 12	−11. 10	
6	−3. 46	*−7. 51*	*7. 53*	2. 37	−2. 78	−32. 76
7	−8. 49	−13. 46	−12. 87	−12. 97	−16. 11	−61. 73
8	−7. 41	−12. 04	−6. 15	−6. 76	−15. 15	−37. 88
9	−6. 03	−10. 61	−7. 56	−7. 29	−6. 19	−39. 46
10	*1. 62*	−2. 82	−11. 86	−11. 31	−4. 16	−24. 11
11	−6. 73	−11. 07	−18. 71	−17. 53	−11. 61	−32. 51
12	−2. 45	−6. 88	−13. 96	−13. 43	−17. 65	−14. 90
13	−. 59	−4. 68	−10. 03			−10. 01
14	−6. 85	−11. 24	−16. 85			−23. 28
15			−15. 28	−15. 50	−19. 15	
16	*8. 12*	2. 89	−17. 42	−4. 94	3. 21	−33. 33
17	*3. 63*	−1. 02	−17. 64			−8. 38
18	2. 36	−2. 06	−8. 64			−19. 99
19	−10. 64	−12. 66	−13. 08	−9. 70	*3. 38*	5. 94
20	−10. 84	−13. 53	−6. 94			−16. 25
21	−3. 00	−6. 26	−3. 02	5. 50	*7. 95*	−23. 15
22	−4. 89	−7. 98	2. 59			−10. 73
23	−8. 47	−11. 74	*2. 17*	. 53	−4. 53	
24	−11. 09	−14. 52	2. 69			
25	−9. 65	−11. 26	*12. 95*	11. 84	−2. 21	
26	−6. 23	−. 33	*9. 82*	9. 56	−3. 03	
27	−2. 74	−5. 35	*5. 82*	4. 74	. 04	
28	−. 15	−3. 29	*14. 74*	11. 35	4. 23	
29	−3. 39	−7. 78	*12. 57*	10. 50	−1. 73	
30	3. 77	. 13	*17. 10*	12. 82	6. 82	
31	7. 68	2. 67	*23. 27*	18. 99	9. 04	
32	18. 98	10. 66	*22. 99*	19. 23	10. 39	
33	1. 03	−3. 12	*5. 45*	3. 75	3. 82	
34	−2. 08	−4. 67	*1. 83*			
35	2. 65	−1. 97	3. 84			
36	13. 12	7. 21	*12. 03*			
37	14. 42	8. 13	*26. 20*	24. 43		
38	20. 53	14. 46	*35. 03*	29. 78	20. 06	
39	4. 15	. 53	*13. 91*	8. 93	3. 26	
40	7. 94	3. 17	*8. 35*	5. 71	3. 13	
41	*11. 10*	6. 11	7. 92	7. 46	5. 23	
42	*7. 46*	3. 22	−3. 91	−4. 24	−5. 39	
43	13. 28	7. 43	15. 41	14. 44	12. 45	
44	1. 92	−2. 32	*14. 35*	13. 67	7. 56	
45	2. 80	−2. 26	*18. 28*	*16. 93*	10. 24	
46	4. 61	−2. 06	*17. 87*	15. 89	7. 85	
47	3. 44	−3. 47	*4. 91*	*4. 92*	4. 74	
48	2. 10	−3. 92	*8. 01*	6. 33	1. 59	
49	*4. 45*	−1. 86	. 07	. 13	3. 75	
50	*1. 76*	−1. 48	−. 93	−1. 07	−6. 45	
51	*1. 82*	−. 61	−. 75			
52	*1. 12*	−. 59	−1. 84			
53	*. 00*	−1. 87	−2. 99			
54	−. 13	−2. 80	−1. 98	−1. 99	−4. 07	
55	*2. 10*	. 73	1. 46			
56	*2. 87*	. 00	2. 87			
57	−1. 01	−4. 21	*. 36*	. 06	−. 61	
58	2. 04	−. 35	*2. 63*			
59	. 32	−2. 94	*8. 04*	8. 02	6. 35	
60	9. 06	3. 64	*12. 96*	2. 93	*12. 96*	
61	*7. 76*	6. 81	1. 84			
62	*3. 47*	3. 05	−1. 71			
63	. 18	−. 60	2. 93	3. 01	*6. 44*	
64	7. 74	5. 59	1. 57	1. 58	*. 15*	
65	9. 46	4. 03	11. 48	11. 53	*13. 16*	

TABLE 3.—*Alternative net earnings per acre from the production of specified crops, and crop rotations at prices implied by the solution to the basic model*—Continued

Region	Food wheat	Feed wheat	Feed grains	Feed grains and soybeans	Soybeans	Cotton
	Dollars	*Dollars*	*Dollars*	*Dollars*	*Dollars*	*Dollars*
66	*4.32*	−0.13	3.10	2.78	−5.44	---
67	*2.68*	−1.39	−4.99	−4.89	−4.83	---
68	−.78	−3.65	−7.38	−6.28	−4.52	---
69	*3.67*	.50	−4.80	---	---	---
70	*3.20*	.95	−.09	---	---	---
71	*4.14*	1.58	−3.33	---	---	---
72	*7.44*	5.57	−2.64	---	---	---
73	*5.05*	3.93	3.61	---	---	---
74	*4.57*	4.10	3.85	---	---	---
75	−3.04	−4.44	−12.26	−11.12	−9.22	---
76	*5.42*	4.87	−4.87	---	---	---
77	*1.00*	.78	.75	---	---	−8.85
78	−.12	−.67	−7.02	---	---	−28.24
79	*4.20*	3.78	−.11	---	---	−8.97
80	*1.52*	1.38	11.51	---	---	*11.58*
81	*2.59*	2.15	.29	---	---	−7.56
82	−.06	−.32	3.53	---	---	*4.54*
83	*1.71*	1.37	−1.70	---	---	−16.00
84	−.71	−1.03	2.06	---	---	−33.93
85	−1.03	−2.22	*5.32*	---	---	−9.43
86	−.25	−.85	−.45	---	---	−34.12
87	−3.37	−4.51	−7.67	---	---	−4.10
88	−1.92	−2.66	15.23	---	---	−2.61
89	2.70	*2.98*	−5.09	---	---	---
90	−.70	*−1.87*	−5.11	---	---	---
91	−1.45	−.99	−12.66	---	---	---
92	−.68	.78	−12.63	---	---	---
93	−1.21	−1.00	−5.80	---	---	---
94	*.60*	.51	−1.12	---	---	---
95	−4.17	−4.07	−.83	---	---	---
96	−1.97	−1.93	−9.10	---	---	---
97	−3.25	−3.16	−9.14	---	---	---
98	.58	*3.49*	−8.86	---	---	---
99	−3.97	−1.44	−12.66	---	---	---
100	7.22	*7.85*	1.37	---	---	---
101	7.76	*7.89*	.70	---	---	---
102	*4.94*	4.20	−7.54	---	---	---
103	*4.78*	3.71	.99	---	---	---
104	1.90	1.19	5.39	---	---	*30.37*
105	---	---	---	---	---	−19.22
106	---	---	---	---	---	−21.01
107	---	---	---	---	−3.88	−23.25
108	---	---	---	---	−7.86	*3.80*
109	---	---	---	---	−11.33	−39.25
110	---	---	---	---	---	−25.44
111	---	---	---	---	---	−19.31
112	---	---	---	---	---	−17.53
113	---	---	---	---	---	−24.27
114	---	---	---	---	---	−26.39
115	---	---	---	---	---	−8.19
116	---	---	---	---	---	25.30
117	---	---	---	---	---	−17.09
118	---	---	---	---	---	−29.78
119	---	---	---	---	---	*58.21*
120	---	---	---	---	---	*22.77*
121	---	---	---	---	---	48.87
122	---	---	---	---	*1.45*	---

the land is used for feed grain production, a net loss of $3.03 is expected. Again, these imputed earnings are based on regional prices associated with the national average prices in table 2.

One purpose for computing alternative earnings such as those given in table 3 under various programming solutions is to show which activities are "near competitors" in each region. Table 3 shows that under the implied supply prices (table 2), in region 37 the feed grain-soybean rotation with expected net earnings of $24.43 per acre is a close competitor of the activity actually selected by the program—the feed grain activity with expected earnings of $26.20. Many other such examples are apparent in table 3.

Limitations of the Analysis

The emphasis in this study is on methodology. The results presented above have certain deficiencies. If the analysis had been less limited in research funds and time, more realistic models might have been constructed. These models would have included not only more crop activities but also some livestock activities. Flax, rice, feeder stock, and slaughter animal activities are being included in later models.

However, the results are helpful as broad indicators of the competitive positions of particular areas as field crop producers and may suggest the general level of surplus cropland or producing capacity for particular crops. In brief, they have diagnostic value in an analysis of comparative advantage among regions. Further, the models demonstrate methodology that appears to have merit for showing prospective regional development and change. More time and refinement will lead to estimates of even greater use in public policy and planning. The current study represents a necessary step in attaining these more refined estimates.

Variable Resource Programming for Appraising Farm Adjustment Opportunities

By Bill Bolton

Economists are faced with the continual need for reliable estimates of farmers' aggregate supply response. They search accordingly for procedures that will reduce the computational burden and strengthen the reliability of these estimates. The author describes how the "variable resource programming" technique can be used to help alleviate a major problem encountered when "representative" farms are analyzed to generate aggregate information. This is the problem of determining the proper kind and number of farms to include in the analysis. The article also illustrates how variable resource programming can contribute a wealth of information pertaining to other production research problems, such as determining the optimum combination of enterprises for specific farm resource situations.

IN RECENT years linear programming has become widely used as a research technique for determining the most profitable combination of enterprises for individual farms under specified conditions. Its use has also been extended to research on aggregate adjustment opportunities and limitations. This is accomplished by expanding the results from the programming of "representative" farms on the basis of resource quantities represented by each programmed situation. For example, Southern Regional Project S–42, a regional adjustment study being conducted cooperatively by Southern agricultural experiment stations and ERS, is using this technique to develop estimates of aggregate outputs for major crop and livestock enterprises at several different product prices.

One of the major problems in using linear programming to estimate aggregate supply response is that of choosing the kind and number of "representative" farms that will minimize the amount of aggregation bias. This bias is simply the discrepancy between (1) aggregate results obtained if every farm is analyzed separately and (2) the aggregate results obtained from a necessary shortcut, such as the analysis of representative farms. The results from programming a given resource situation are highly specific and usually limited with respect to the number of enterprises in the final plan. Therefore, a large number of representative farms may be required to properly reflect the feasible alternatives for an area.

Variable resource programming is a practical way of generating considerable information about the effects of variation in the resource base without having to program a large number of representative farms.[1]

This paper illustrates how the quantity of land can be varied over a wide range, with other factors or restrictions either remaining fixed or being varied proportionately with land. This is appropriate because the planning period normally used is so long that few resources remain "fixed."[2] Labor hiring activities are commonly used for many classes of labor. Non-real-estate capital items are assumed to be variable, available in unlimited quantities at a given interest rate, or available in proportion to some specified equity position. Land and resident labor force are the only resources generally assumed to be fixed, or semifixed, in quantity.

When the varied resource, such as land, forms part of the basis on which major resource situations are defined, variable resource programming has the effect of expanding the programmed situations to a much larger number than may be obtained otherwise. The aggregate results thus obtained may be more realistic than those obtained from programming a few "representative" farms with many more resource restrictions assumed, but with all restrictions fixed at one level.

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[1] Since linear programming assumes linearity of all relationships, it is possible to examine the effects of varying one of the resources over its entire range by computing solutions at only a few points: namely, at those points where changes in the variable factor cause changes in the optimum program. For a complete discussion of variable resource programming see E. O. Heady and W. Candler, *Linear Programming Methods*, Iowa State College Press, Ames, 1958, Ch. 7.

[2] For further discussion on this point and its implications see Gerald W. Dean, Stanley S. Johnson, and Harold O. Carter, "Supply Functions for Cotton in Imperial Valley, California," *Agr. Econ. Res.*, Vol. XV, No. 1, January 1963, p. 7.

An Illustration

The basic data and assumptions being used in the Mississippi River Delta phase of the Southern Regional study, referred to earlier, are well adapted to use in developing an illustration of variable resource (land) programming. Following is a brief description of the procedure and and assumptions used in the Delta study.[3]

Nine resource situations were recognized: all combinations of three farm sizes and three soil compositions. Appropriate enterprise budgets were developed for each situation.

The three sizes of farm considered were: (1) under 100 acres of cropland, (2) 100 to 250 acres of cropland, and (3) over 250 acres of cropland. For programming purposes the three size groups were represented by farms with cropland of 40 acres, 160 acres, and 640 acres.

The physical resource (soil) situations recognized were: (1) clay land farms, (2) mixed land farms, and (3) sandy land farms. Each type of farm was composed of specific proportions of clay, loam (mixed), and sandy soils. For example, the mixed land farm contained 44 percent clay type soil, 42 percent loam type soil, and 14 percent sandy type soil.

Assumptions as to labor force varied by size of farm. On the small farm some unpaid family labor in addition to that of the operator was available and additional labor could be hired only for chopping and harvesting cotton. On the medium size farm, no unpaid family labor other than that of the operator was available and additional labor could be hired only for chopping and harvesting cotton. On the large farm all labor was hired.

Capital was assumed to be unlimited at the rate of interest specified.

Thus, major operating restrictions for each programmed situation were in terms of total cropland, resident labor (on a period basis), a cotton acreage limitation, and specified amounts of clay, loam, and sandy soils. No major changes were necessary in moving to the variable land programming technique.

The results of variable land programming for the Delta mixed land farm are shown in table 1.[4] The optimum enterprise combination and the resulting net return at 100 acres of cropland, the initial program, are shown as enterprise combination A in table 1. An item of output for each computed program is the amount by which total cropland could be increased without changing the most profitable enterprise mix. In this case the figure was 68.5 acres. Therefore, the second program, designated as enterprise combination B in table 1, was run at 168.6 acres of cropland. The most profitable enterprise combination computed at 168.6 acres, however, applies for only 4.2 additional acres or through 172.8 acres of cropland. A third program is computed at 172.9 acres (enterprise combination C). This process can be repeated, computing a new program each time the enterprise mix changes, until no additions to net returns are made from further increases in acreage, or until there is no interest in additional programs.

All relationships are linear between any two consecutive optimum programs shown. Therefore, any program datum for any point between two computed programs can be determined easily by interpolation. For each 1-acre increase in cropland between enterprise combination C and enterprise combination D in table 1, for example, there is a $48.59 increase in net returns, a 7.08-acre decrease in clay corn (corn grown on clay soil), a 2.37-acre increase in clay soybeans, a 4.97-acre increase in clay wheat, and so on for other enterprises. At 176.9 acres of cropland then, net returns would be $9,826; acres of clay corn would be 22.0. Quantities of all other enterprises could be computed similarly.[5]

At any point the *composition* of the enterprise mix is determined by the previous optimum. The *amount* of each enterprise in the mix is determined

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[3] For additional background on data, procedures, and assumptions see *Progress of Regional Project S-42, July 1, 1958–September 30, 1962*, prepared by James H. White, Chairman, Technical Committee, University of Arkansas.

[4] Data used are based on advanced technology budgets from *Budgets for Major Farm Enterprises in the Mississippi River Delta of Arkansas, Louisiana, and Mississippi*, Dept. Agr. Econ. Cir. 281, La. Agr. Expt. Sta. in cooperation with Ark. and Miss. Sta. and U.S. Dept. Agr., June 1961.

[5] More generally, if B represents a new point to be computed, A the optimum preceding it, C the optimum succeeding it, X the the value of net returns (for any given enterprise), and Y the value of the resource being varied, then the value of X at the new point is: X at A plus (X at C minus X at A) (increase in Y from A to B divided by increase in Y from A to C).

TABLE 1.—*Optimum enterprise combinations with cropland varying upward from 100 acres, 1-man labor force, mixed land farm in the Mississippi River Delta area* [1]

Item	Enterprise combination								
	A	B	C	D	E	F	G	H	I
Total cropland____________acres__	100. 0	168. 6	172. 9	180. 0	184. 3	245. 0	254. 6	265. 9	272. 8
Clay corn [2]____________do____	35. 2	59. 3	50. 3	--------	--------	--------	--------	--------	--------
Mixed cotton____________do____	19. 8	33. 4	34. 2	35. 6	36. 5	11. 5	8. 2	3. 1	--------
Sandy cotton [2]__________do____	14. 7	24. 8	25. 4	26. 5	27. 1	36. 0	37. 4	39. 1	40. 1
Mixed corn_____________do____	21. 5	36. 2	37. 2	38. 7	39. 6	89. 7	91. 9	93. 3	94. 4
Noncrop pasture__________do____	8. 8	14. 8	15. 2	15. 8	16. 2	21. 6	22. 4	23. 4	24. 0
Clay soybeans___________do____	--------	. 1	10. 5	27. 3	--------	--------	--------	. 1	3. 1
Clay wheat_____________do____	--------	--------	. 1	35. 4	36. 2	--------	--------	--------	--------
Clay pasture____________do____	--------	--------	--------	. 7	28. 7	86. 1	89. 6	93. 5	92. 9
Mixed soybeans__________do____	--------	--------	--------	--------	--------	--------	. 1	13. 4	18. 3
Mixed pasture___________do____	--------	--------	--------	--------	--------	. 1	5. 0	--------	--------
Net returns [3]___________dollars__	5, 577	9, 398	9, 632	9, 977	10, 181	11, 555	11, 700	11, 863	11, 950
Total operating capital required do____	6, 476	10, 912	11, 084	11, 164	11, 257	11, 034	11, 021	10, 970	10, 940
Per acre operating capital required________________do____	64. 76	64. 76	64. 14	62. 06	61. 11	45. 04	43. 32	41. 27	40. 09

[1] Values for a 2-man labor force are obtained by multiplying by 2; for a 2-man labor force net returns (without labor costs) for enterprise combination A would be $11,154, total cropland would be 200 acres, clay corn would be 70.4 acres, etc. For a 3-man labor force the values are multiplied by 3, and so on for any size labor force.

[2] Clay corn means corn on clay type soils, sandy cotton means cotton on sandy type soils, etc.

[3] Returns to land and operator's labor and management.

by the rate of change between the preceding and the succeeding optimum. Clay corn, for instance, is in the enterprise mix in decreasing amounts at all points between combinations C and D, although it goes out completely at 180 acres. Pasture on clay soils, on the the other hand, enters the enterprise mix at 180 acres, but is not in at any point between 172.9 and 180 acres.[6]

Alternatively, quantities shown under enterprise combinations A and B, or any two consecutive combinations, can be represented as points on a two-dimensional chart, and connected by straight lines. This has been done for net returns in figure 1. Points shown on the one-man segment of the line in figure 1 correspond with the net returns shown in table 1. Net returns for any given total cropland can now be read directly from figure 1, and reference to table 1 will provide corresponding information on the enterprise mix.

Various labor restrictions become limitational between enterprise combinations A and I in table 1 and figure 1. The labor service incorporated in a single laborer, consisting of several labor restrictions, becomes increasingly scarce relative to land. According to the assumptions used here the fixed nature of the labor resource rests upon the characteristics of "lumpiness" or indivisibility of the input. That is, resident laborers are added in full units and their full productive services are available whether used to capacity or not. At some level of the resource being varied, however, it may become feasible and profitable to add more units of the fixed resources.

Since no other resources are really restrictive (i.e., the problem has been so stated that the cotton acreage restriction and the various soil restrictions vary with total cropland), it is possible to combine the programs already computed with larger labor forces. That is, if a two-man labor force were assumed, instead of the one-man force used to this point, labor availability in all periods would be doubled. Reprogramming, then, using a two-man labor force would simply double all values shown in table 1. The use of a three-man labor force would result in all these values being tripled. Su-

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[6] Conventional linear programming, of course, yields information on the range of sizes (or other resources) over which a given enterprise mix applies. If a program were run for a 200-acre farm, with the same data used here, enterprise combination E would apply and the program would indicate that 184.3 acres and 245.0 acres constituted the lower and upper limits, respectively, for this program. It would *not* indicate the *amounts* of each enterprise that would apply at other acreages within this range, say at 225 acres. These could be determined only if enterprise combinations E and F were computed.

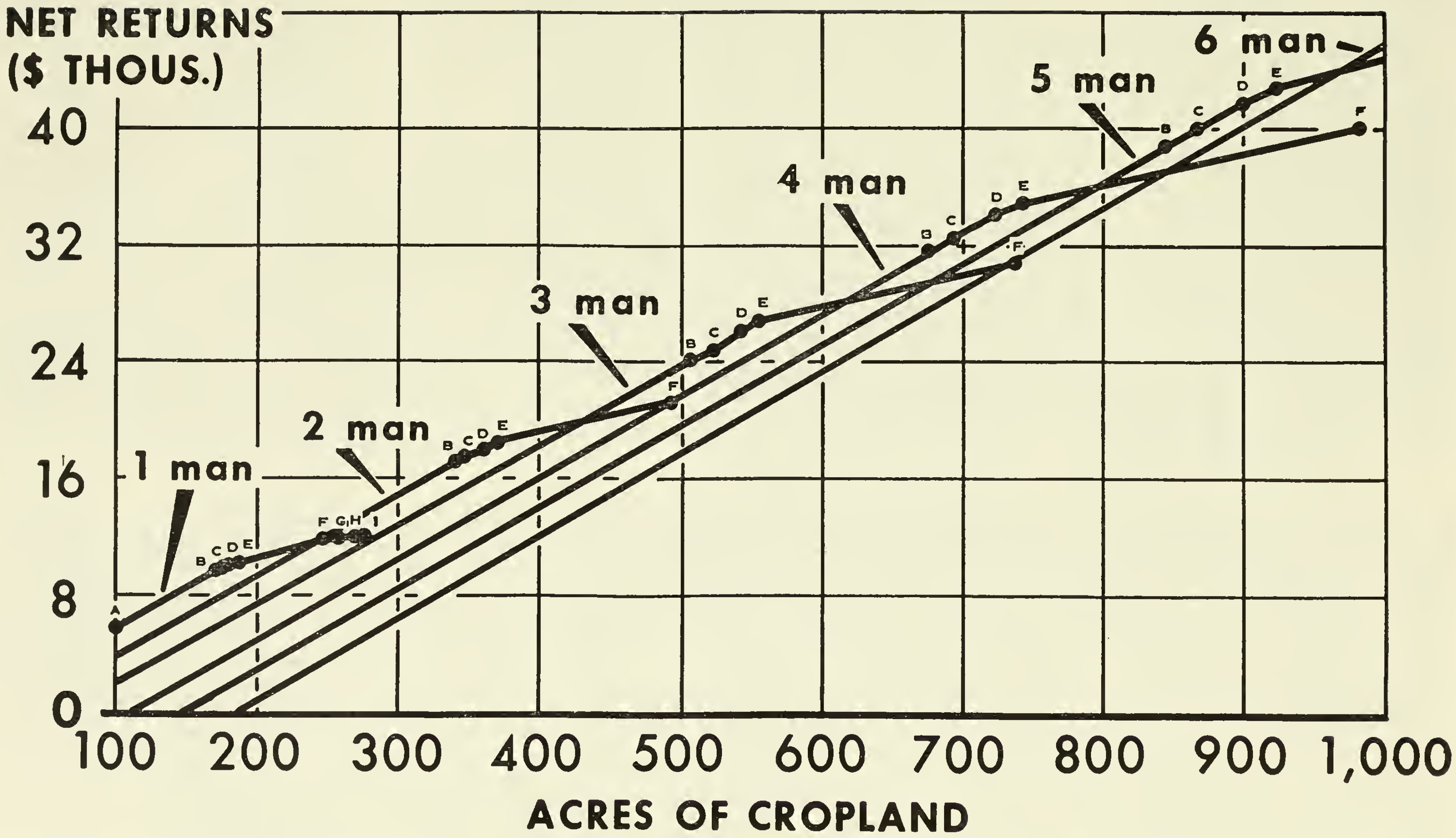

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FIGURE 1.—*Highest possible net returns for various enterprise combinations, by size of farm and size of labor force, owner-operated mixed land farms in the Mississippi River Delta area.*

pervisory time associated with different sizes of the labor force is discussed in the next section.

Net returns, assuming additional men in the labor force with each additional man being employed at a fixed annual cost of $2,000, have been plotted on figure 1 in the same manner as for a one-man labor force. For example, with a two-man labor force, enterprise combination B occurs at 337 acres of cropland and yields a net return of $16,796, or $18,796 minus $2,000 for hired labor.[7] For a three-man farm this enterprise combination occurs at 506 acres and has a net return of $24,194, or $28,194 minus a $4,000 labor cost.

Thus, net returns are maximized for a farm up to a size of 245 acres with a one-man labor force, for a farm from 245 to 420 acres with a two-man labor force, and for a farm from 785 to 975 acres with a five-man labor force. This can be determined from figure 1 by following the "highest possible net returns" lines. From these lines it can be seen that at 275 acres, for example, it would be possible to operate as a one-man farm (enterprise combination I), or with any larger labor force (enterprise combination A); however, net returns are highest with the two-man labor force.

The same optimum enterprise combinations continue to recur as size increases (and the size of the labor force increases), although not necessarily to the same extent in areas including maximum net returns. For example, smaller amounts of enterprise combinations A and F are produced as size of the labor force increases.

The advantage of the variable programming procedure, in terms of generating data for aggregation, can now be illustrated from figure 1 and table 1. Assume that, with standard programming, 160 acres is selected to represent all farms between 100 and 250 acres in size, and that 640 acres is selected to represent all farms over 250 acres in size. Enterprise combination A, consisting of cotton, corn, and noncropland pasture, is the optimum enterprise combination for the 160-acre farm. But, if this program were inflated and made to represent all farms of 100 to 250 acres, it would overstate the importance of cotton and corn, understate the importance of beef cattle, and ignore soybeans and wheat altogether. Enterprise combination A is also the optimum combination for 640 acres of cropland. But enterprise combination A is even less representative of farms over 250 acres than of those below 250 acres in size. On the other hand, it would be possible to reduce aggregate bias considerably by increasing the number of intervals aggregated. This can be done by expanding from the midpoints of each of the maximum net return line segments in figure 1.

Treatment and Effect of Fixed Costs

Any relevant fixed or overhead cost, whether it enters as a single indivisible increment or varies with farm size, can be built into the analysis.

Because of recent interest in the effect of land charges and of changes in factor prices in general on certain relationships, such as minimum requirements for specified income levels, fixed costs will be discussed in terms of land charges.

The data in table 1 and figure 1 were based on the assumption of zero land charges. Now assume that clay soils are valued at $100 per acre, mixed soils at $200 per acre, and sandy soils at $300 per acre, and that rates of 5 percent of these values are used as land charges.

If the mixed land farm is reprogrammed, using these land charges as an additional cost, the results will be exactly the same as those shown in table 1, *except* that net revenues will be reduced at each optimum by the amount of the total land charge applicable at that point. If these new net returns data were charted, it would be seen that the optimum enterprise combination and the optimum labor force for a farm of any given size remain unchanged.

The effect of adding a single fixed cost that remains unchanged over all ranges of size would be the same as that indicated for a cost that varies with size. Proportionate reduction in income would, of course, decrease as size increased, but neither optimum enterprise combination nor optimum labor force would change for a given farm. This could be demonstrated by adding a fixed cost of (reducing net returns by) $4,000 at 100 acres and recharting the data, from table 1.

According to cost theory, this is exactly the way that fixed costs are supposed to operate. The effects of fixed costs are frequently misinterpreted, however. It is particularly easy for erroneous effects to be attributed to fixed costs when conventional linear programming is done at a few discrete size levels and at various levels of fixed costs. With variable land programming any level of fixed costs can be conveniently added at any point with the effects, or lack of effects, more easily seen.

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[7] It is assumed that the first man is the operator, therefore no charge is made for his labor; that the two-man farm uses one hired man and has a total labor cost of $2,000; that the three-man farm uses two hired men and has a hired labor cost of $4,000, and so on.

Semifixed costs.—Certain costs might be characterized as semifixed. That is, they are added at a given size and remain unchanged over a range of sizes whether or not the services they represent are fully utilized. But at some size level it may become profitable to add an increment. Cost for regular hired labor, as it has been used to this point, displays these characteristics.

There is no difference between the effects of these costs and those discussed above *if* it can be assumed that each increment of input for items of this nature has the same cost, and that changes in this cost affect each increment equally. For example, it was assumed in figure 1 that all or any part of the services of each additional resident laborer was hired at a cost of $2,000. If it were assumed that the cost of each laborer increased by $3,000 the only effect on figure 1 would be a reduction in net returns for any given farm.

It may not always be valid, however, to assume that more increments of these inputs can be added at the same cost. Instead of the simple assumption that each addition to the labor force costs $2,000, assume that the resident labor force grows as follows:[8]

Effective resident labor force	Hired labor	Labor cost
1	None (operator works)	None
2	1 (operator also works)	$2,000
3	3 (operator now supervises, keeps books, repairs machinery).	6,000
4	5 (including bookkeeping and some supervision).	11,000
5	7 (including additional supervision and shop work).	17,000

These new labor costs will have no effect on the enterprise combination as programmed for a given size (effective) labor force. They will, however, affect the size of farm at which it becomes profitable to hire additional laborers, and consequently will affect the range over which the various enterprise combinations are most profitable.

The new labor costs can be subtracted from the net returns shown in table 1 to get new return figures. For example, under these assumptions enterprise combination E on a three-man farm would now have a net return of $24,543, or ($10,181 ×3) −$6,000. New net returns obtained by this procedure are charted in figure 2.

Comparison of figures 1 and 2 indicates that, while optimum enterprise combinations are unchanged, the increase in labor costs has reduced net returns for farms over 425 acres in size, resulted in larger farms for a given effective labor force, and changed the relative importance of the various enterprise combinations. Enterprise combination E, for example, is now produced almost exclusively over the entire range of sizes above 550 acres, whereas combinations A, B, C, and D were produced in considerable quantities at these sizes under the old cost structure.

Different Levels of Use of Resources and Prices

Apart from interest in aggregation, variable resource programming can be useful for examining the effects, over a range of a particular resource, of changes in resource requirements, resource situations, or prices. An illustration will be presented in terms of changes in acreage allotments and prices. Others could be used to reflect changes in tenure, technology, or any other change in the basic situation.

To this point it has been assumed that cotton was limited to 34.5 percent of total cropland, which has been the approximate average level of Delta cotton acreage allotments for several years. With cotton acreage allotments changed to 24.5 percent of cropland the optimum enterprise combinations and corresponding net returns are as shown in table 2.

Net returns at all levels of size (again assuming that additional laborers are hired at a cost of $2,000 as it becomes profitable to do so) are charted for the 34.5 and 24.5 percent cotton restrictions in figure 3. Cotton price remains at 31.2 cents per pound of lint for the two allotment levels.

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[8] This example introduces an element of diminishing returns to labor by requiring increasing amounts of, and more expensive, labor to perform a given amount of work. Six men, including the operator, constitute a four-man effective labor force (six times as many men are needed to do four times as much work as one man). Labor costs also rise as supervisory and other specialized labor is hired.

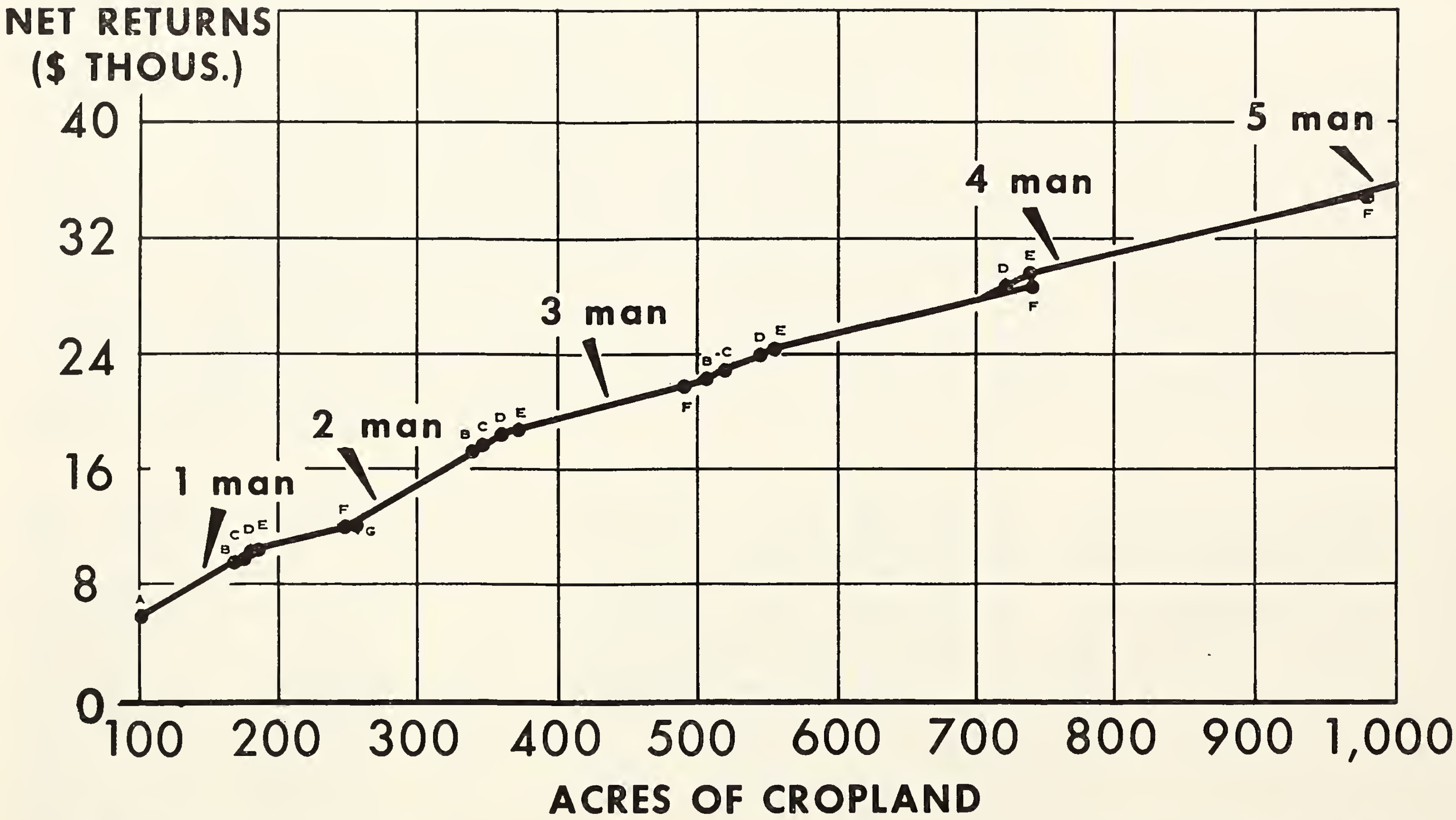

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FIGURE 2.—*Net returns under conditions of increasing labor costs, by size of farm and size of labor force, owner-operated mixed land farms in the Mississippi River Delta area.*

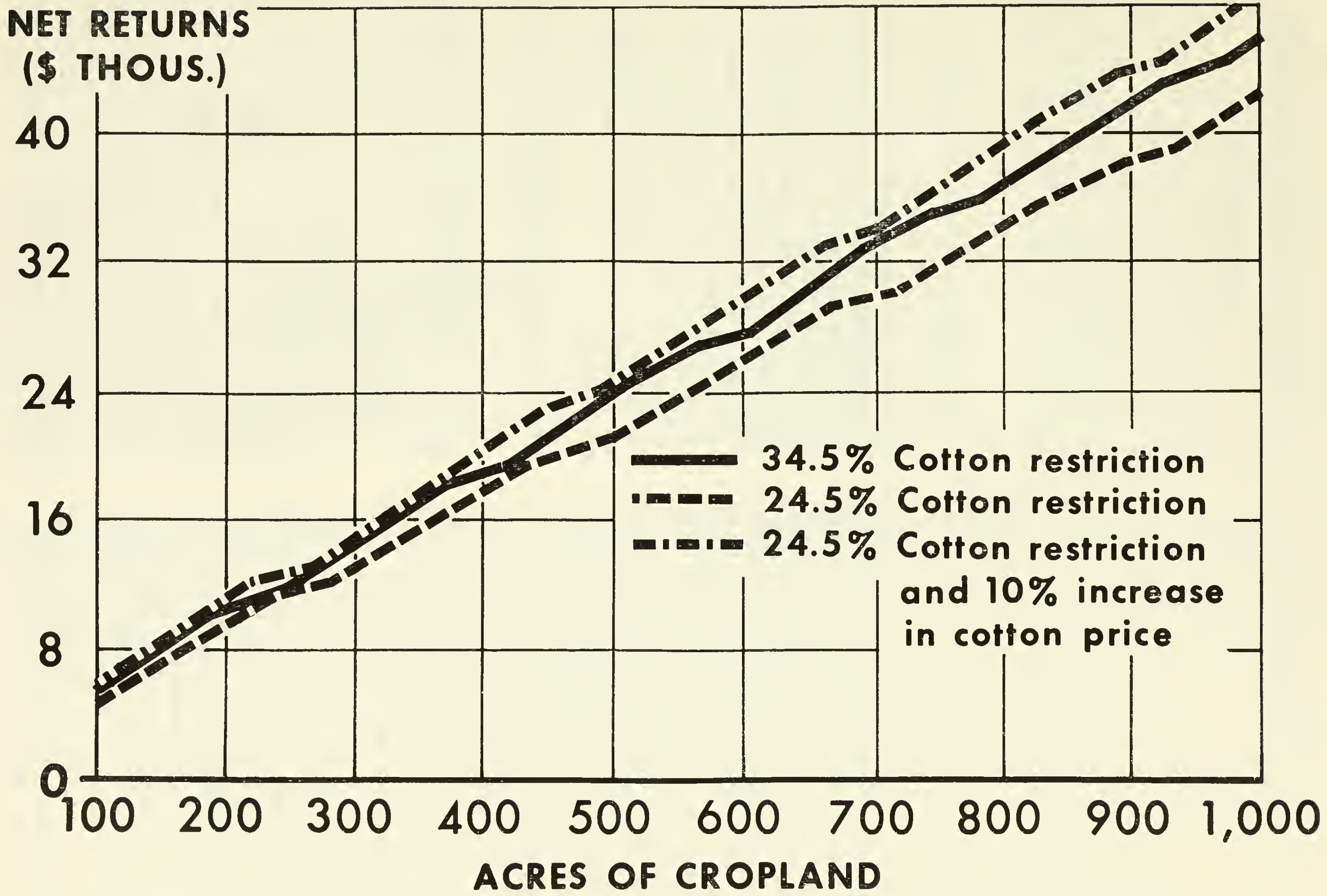

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FIGURE 3.—*Net returns with different levels of cotton acreage restrictions and cotton prices, owner-operated mixed land farms in the Mississippi River Delta area.*

TABLE 2.—*Optimum enterprise combinations with 1-man labor force and cotton acreage restriction at 24.5 percent of cropland, owner-operated mixed land farm in the Mississippi River Delta area*

Item	Enterprise combination					
	A	B	C	D	E	F
Total cropland acres	100.0	182.8	206.0	209.3	220.5	245.0
Clay corn do	35.2	64.1	20.3			
Mixed cotton do	9.8	17.9	20.2	20.5	21.6	11.5
Sandy cotton do	14.7	26.9	30.3	30.8	32.4	36.0
Mixed corn do	31.5	57.6	64.9	65.9	69.5	89.7
Noncrop pasture do	8.8	16.1	18.1	18.4	19.4	21.6
Clay wheat do			.1	14.0	14.6	
Clay soybeans do		.2	52.1	59.6		
Clay pasture do				.1	63.0	86.2
Net returns dollars	5,047	9,225	10,367	10,513	10,999	11,555
Net returns with 10 percent cotton price increase do	5,681	10,384	11,672	11,839	12,396	12,832

Incomes are higher for the 34.5 percent level than for the 24.5 percent level of cotton allotments except for a small range in size (net returns are the same for the two allotment levels between 220 and 245 acres). However, the absolute and relative income differences vary at different farm sizes. At 600 acres, for instance, net returns are about $1,200 higher with the larger allotment. This difference rises to about $3,200 at 700 acres, but declines to about $2,200 at 800 acres.

What about the possibility of compensating, through an increased cotton price, for the loss of income accompanying the reduced acreage allotment? The 24.5 percent allotment situation was reprogrammed with a 10 percent increase in the price of cotton. The price increase had no effect on optimum enterprise combinations. This result was inevitable for enterprise combinations through E since these combinations contained all the cotton acreage permitted by the restriction at the lower price. It would be possible to set the cotton price high enough to change enterprise combinations beyond E, but this did not happen with the 10 percent price increase. The price increase did, of course, increase net returns at all sizes. The new net returns are shown in table 2.

Net returns with a 10 percent cotton price increase are charted in figure 3 for the 24.5 percent allotment. With the increase in cotton price, farms are more profitable at all size levels with a 24.5 percent cotton allotment than with a 34.5 percent allotment and the old cotton price. The price increase has not, however, served to equalize the relative income differences created by the reduction in cotton allotments. In general, those farms on which income suffered least from the acreage reduction now tend to gain most from the price increase. A farm of 640 acres would gain approximately $2,400 from the reduced acreage and increased price for cotton, while farms at 500 acres would gain about $400. Conversely, if a price were set that would just offset losses from reduced cotton acreage at 640 acres, farms at other sizes would suffer decreases in income.

Thus, there are differential effects of the changed situation, over the range of size, that would be difficult to develop by programming at discrete sizes.

Minimum Resources Required for Specified Levels of Income

Linear programming has also become widely used as a technique for determining minimum amounts of resources required to attain specified levels of income.

Variable resource programming, as illustrated in table 1, accomplishes a determination of the minimum amount of cropland necessary to attain specified income *at the same time* that the optimum enterprise combination for maximum income is determined. The minimum cropland for attaining $8,000 income, for example, is approximately 145 acres (fig. 1). An income of $16,000 would require approximately 325 acres. Acreage figures corresponding to the specified income level are simply read from the chart. Precise total cropland requirements for these income levels, together with the amounts of the various enterprises to be produced, can be computed from table 1 by interpolation as illustrated previously.

This procedure has the same advantages for minimum resource programming as for optimum enterprise combination programming: the minimum amount of cropland or other resources required can be determined for any income level in contrast to one or a few finite levels, and some insight is furnished as to the stability of the program for a particular income level, i.e., over how wide a range of the varied resource it applies. The technique can also be used to appraise the effects on minimum resource requirements of changing resources, technology, product prices, factor prices, or other variables.

Evaluation of Uses and Limitations

It has been demonstrated that variable resource programming has certain advantages over conventional programming, at least for the type of problems and resource restrictions considered here. The increase in computing time is far less than proportional to the increase in information produced. If it is intended to examine both minimum resource and maximum income aspects of a problem, and at different levels of product and factor prices, variable resource programming requires less computing time than conventional programming.

The framework of problems and assumptions used in this report has, of course, been ideal for the use of this technique. First, it was assumed that farm size is an extremely important variable. This assumption was implicit in the S–42 procedure on which the data used were based.

Second, it was assumed that, while there are multiple labor restrictions, the quantities of labor available during different periods are embodied in indivisible individuals, and that additional labor must be added in these indivisible increments, i.e., all labor is performed by the operator or by regular hired laborers. Some labor is, or could be, hired on a seasonal or piece-rate basis, but this poses no problem. In fact the data used assumed that certain labor was hired on a seasonal basis, and the cost of this labor was simply subtracted from enterprise net returns. Alternatively, a labor hiring activity could have been added to hire additional seasonal labor, confined to specific enterprises and operations if desired.

The use of unpaid family labor, other than the operator, would present a problem. Assume a given quantity of unpaid family labor available in a particular restriction period. This would change the optimum enterprise combinations for any of the examples used in this report. But the quantity of this labor obviously would not double when the second man is added to the labor force. If this labor were a close substitute for seasonally hired labor it could be handled by adding seasonal wage rates for its use to net returns. But, if it were available during periods or for operations for which seasonal, piece-rate, or part-time labor normally cannot be used (milking cows for 2 hours per day, for instance), it would cause difficulty. Land still could be varied up to the limit of the available initial labor restriction, of course, but labor could not be simultaneously varied without considerable modification of the system.

Third, unlimited capital was assumed. For most of the examples used this was not a particularly bad assumption. The initial S–42 work has been in terms of farms operated by owners with high equity in their property. In this case it is not unreasonable to assume that adequate capital can be obtained to finance operating expenses and desired improvements. If capital were restricted at some given level, say $5,000, variable land programming could still be done to the limits imposed by initial labor and capital restrictions. But it would not be possible to move to the two-man labor force unless it could be assumed that the initial capital level doubled for a two-man farm.

It does not seem reasonable to assume that capital remains fixed as size increases. That is, it would be expected that a going farm of 300 acres would have access to more capital than one of 100 acres, independent of equity considerations. Therefore, a capital restriction that varies in some way with size would seem to be a more reasonable assumption than a fixed sum of capital over a range of sizes. What level of capital restriction should be used? If a particular capital availability is known to exist, there is no problem; it should be used. But no one can specify a completely valid capital restriction for a group of farms, or even for a single farm, with any degree of certainty. This leaves an alternative of programming at various levels of capital availability to gain some insight into the effect of capital on optimum plans. But, again, what levels should be chosen?

The program can be used to determine the amount of capital required for each optimum plan under the assumption of unlimited capital. Capital requirements so determined (based on operating capital requirements) are shown in table 1. It can be seen that the largest amount of capital required for any optimum combination is $64.76 per acre. Capital available in excess of $64.76 per acre is not used over all ranges of size. There is no interest in any capital restriction above this figure.

A small amount of variable capital programming, with land held constant, indicated that any capital restriction below $40.71 per acre forces some land into non-use over all ranges of size in which we are interested (enterprise combinations A to F). In view of the importance given to land in this problem there would be little interest in capital restrictions below this figure.

Capital restrictions, then, should lie between $40.71 and $64.76 per acre. Different levels of capital within this range will definitely have various effects on the optimum enterprise combinations. The specific restrictions chosen between these limits would depend upon the area, the problem, and the judgment of the investigator.

The method used in this report rests essentially on the fact that multiple resource restrictions have been reduced to two absolute restrictions. Restrictions on land of different qualities, on cotton acreage, and implicitly on capital, have been made to vary with total cropland. Multiple restrictions on labor have been allowed to operate as individual restrictions, but have been at the same time considered as components of a larger fixed labor increment, i.e., one man. In this way *simultaneous variable programming* has been accomplished, in effect, for land and for labor.

Had it been necessary to add a third absolute restriction the system would not have worked past the limit in size imposed by the original level of restrictions. For instance, if hogs had been considered as an alternative and hog housing were included as a restriction, it would not be possible to double all quantities when the quantity of labor doubled. In this case one could reject this method or make a reappraisal of hog housing to determine whether it actually is an absolute restriction, or whether additional hog housing would be forthcoming if hogs were profitable. If the latter view were taken, a cost for hog housing could be entered in the hog budget, with its capital requirements drawing against the total capital restriction.

It is possible that there are a number of problems in which land, labor, and capital, per se, could be considered as the relevant restrictions, with various subrestrictions of these three items related to them in definite quantities or proportions. If capital can then be related to size, variable land programming, as it has been illustrated here, can be used.

Suppose that the above assumptions cannot be made; that there are indeed additional resources that must be considered to exist in fixed quantities over an infinite range of farm sizes. This would neither rule out the possibility nor reduce the usefulness of performing variable land programming in conjunction with varying levels of hired labor. It would simply require more programming time. Reprogramming would now be necessary as each additional man is added to the labor force, but the results of these separate programs could be tied together to yield the same type of relationships as those shown in this report.

Excess Capacity in U.S. Agriculture

By Fred H. Tyner and Luther G. Tweeten

The commercial farm problem has been defined as an excess of farm output over utilization at "satisfactory" prices. Evidence of farm production in excess of market outlets has been apparent in declining farm commodity prices and net incomes, growing stocks of farm products, or large Government costs for price supports, production restraints, and surplus disposal. Programs such as free markets, mandatory production controls, and action to increase exports and the mobility of farm resources have been advanced as possible solutions to problems of overproduction. A definitive analysis of ameliorative measures requires first an estimate of the problematic gap—the excess capacity in agriculture. This gap, defined in terms of the difference between the existing situation and some acceptable norm, is one measure of the magnitude of the problems faced.

EXCESS capacity can only be defined relative to some price level. Presumably, at some set of commodity prices all farm production would be utilized in normal market channels. In this study, the magnitude of overcapacity is defined as the excess of production over utilization at socially acceptable prices. The "excess production over utilization" is regarded as the total Government diversions of commodities from regular market channels. "Socially acceptable prices" are national average farm commodity prices resulting from Government stabilization of prices through CCC, acreage removals, and export programs. This definition of socially acceptable prices is expedient for our purposes, but is somewhat arbitrary and unsatisfactory due to the imperfect political process, realignment of interest groups, and changing preference patterns.

Past estimates of the magnitude of oversupply of farm products range from 4 to 10 percent (*1, 3, 5, 8, 9, 10*).[1] Hathaway and Jones estimated that Commodity Credit Corporation activities removed as much as 8.5 percent of total farm products from market outlets in 1955 (*6*). Other estimates of excess capacity were obtained indirectly from studies that were directly focused on the implications of free markets for agriculture (*8*). These studies assumed that some major Government programs—for exports, CCC, or Conservation Reserve—were continued, hence they did not measure total diversions. This paper is an attempt at a more comprehensive listing of the Government's role in controlling farm production and marketing from 1955 to 1962.

Scope and Method

The primary objective of this paper is to define the magnitude of aggregate excess productive capacity in U.S. agriculture as a basis for determining adjustment needs and trends. Excess aggregate production implies an overcommitment of resources to agriculture and an oversized agricultural plant. Specification of the adjustment gap is the first step for later research relating the excess capacity to resource levels and combinations, and determining resource adjustments necessary to bring production in line with utilization. Emphasis in this study is on estimating the magnitude of the gap rather than relating it to prices; however, as a secondary objective we illustrate how much the oversupply of farm commodities would have been reduced at various price levels.

The procedure is to define the adjustment gap annually over the period 1955–62 in terms of value of production diverted from the commercial market by Government storage operations (CCC), land withdrawal programs (ASCS Soil Bank and others), and subsidized exports (P.L. 480, etc.). The sum of the value of these diversions (at current prices) for all major farm commodities is defined as aggregate excess production capacity, and the ratio of this sum to the value of total agricultural production is the adjustment gap in each particular year.

The annual adjustment gap is defined not for the calendar year, but for the fiscal, marketing, or crop year to conform with the available data. CCC and export data are by fiscal year. We weight quantities by average prices received by farmers during the crop marketing year.[2] Acreage Reserve, Conservation Reserve, and compensatory payment program diversions for year *i*, e.g., 1960, are used in calculations for "year" (*i*)—(*i*+1); e.g., 1960–61. Values of total farm output are specified similarly. For example, the "analysis year" 1960–61 relates to CCC stock accumulation and subsidized exports for fiscal 1961, Soil Bank diversions for 1960, marketing year prices for 1960–61, and value of total farm output for 1960.

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[1] Italic numbers in parentheses refer to the Literature Cited, p. 30.

Government Storage Operations

A major facet of Government price support programs has been the withholding of commodities from the commercial market through storage operations. The Commodity Credit Corporation acquires its stocks of "owned" commodities through (1) acquisition of commodities pledged as collateral for price support loans, and (2) purchases from processors or handlers, or from producers by purchase agreements (*12*). These acquisitions less domestic disposals by CCC may be considered as surplus production, i.e., they would not enter the commercial market at acceptable prices.

Domestic dispositions are regulated by Section 407 of the Agricultural Act of 1949. They include sales for dollars, transfers to other Government agencies, donations, and payment in kind for unrestricted use. CCC diversions are calculated as acquisitions minus domestic dispositions. The value of commodities used in school lunch and welfare programs is not considered part of surplus production.

Table 1 shows the value of diversions (acquisitions less domestic dispositions) by Government storage and purchase operations for 11 major commodities for the fiscal years 1956–62. These values were calculated as the quantities diverted times the seasonal average price received by farmers for the respective commodities.[3] Acquisition quantities for tobacco are new loans made during the year; for lack of better data, the loan quantities are considered to be removed from the commercial market (*6*, p. 861). All other commodity figures represent quantities actually acquired by CCC. Ten of the commodities (tobacco loans excluded) comprised between 90 and 94 percent of the cost value of CCC acquisitions except in 1958–59 (85 percent) and 1961–62 (79 percent).

A general tendency for net diversions to decline is apparent in table 1. This trend was prompted in part by growing CCC stocks, which suggested placing greater emphasis on export and such programs as land diversions in the Soil Bank and the Emergency Feed Grain Program rather than accumulation of unneeded stocks. Net diversions declined from a high of $2.2 billion in 1955–56 to net *sales* of $0.3 billion in 1961–62. The downward trend was interrupted only by net diversions of $1.7 billion in 1958–59, reflecting the record wheat crop in 1958.

Land Withdrawal Programs

Acreage allotments for basic crops (wheat, corn, cotton, peanuts, rice, and tobacco) were authorized under the Agricultural Adjustment Act of 1938. These allotments have helped to control the output of the basic crops. However, excess production was not limited to these crops alone—and, without cross-compliance measures, land diverted from these crops could be used to grow other crops. These programs may have had little influence on the total volume of production (*13*). Hence, we only consider control programs designed to remove cropland from production.

Excess production was largely responsible for a drop in realized net income of farm operators from farming—including Government payments—of nearly a fourth in the period 1951–55 (*4*), resulting in the passage of the Soil Bank Act in 1956. The Soil Bank had two components, the Acreage Reserve and the Conservation Reserve. The Acreage Reserve program was in effect for tobacco, rice, cotton, wheat, and corn during 1956–58, and for peanuts during 1956 only. The Conservation Reserve program applied to any land normally used to grow crops. Farmers were allowed to make contracts of 3 to 10 years' duration from 1956–60. Cropland placed in the Soil Bank

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[2] Weighting Government removals of all types by seasonal average prices is only an approximate procedure because (a) the quality of commodities removed by CCC storage, ASCS land withdrawal, or export subsidies may not be comparable to the quality of commodities moving in the markets, and (b) the relative prices may be a function of the type and emphasis of the particular Government program.

[3] Dairy products (milk equivalent) weighted by manufacturing milk prices.

Table 1.—*Estimated value of diversions by CCC, 11 major commodities, fiscal years, 1956–62* [1]

Commodity	Fiscal year						
	1955–56	1956–57	1957–58	1958–59	1959–60	1960–61	1961–62
	Million dollars	*Million dollars*	*Million dollars*	*Million dollars*	*Million dollars*	*Million dollars*	*Million dollars*
Wheat	483.1	239.2	261.6	747.3	310.0	420.1	102.1
Rice	55.0	[2]−9.2	[2]−23.8	33.9	20.9	10.2	[2]−13.9
Rye	12.0	3.0	7.6	5.7	.7	1.3	.1
Corn	255.4	311.5	391.1	181.6	168.9	155.3	[2]−530.2
Grain sorghum	78.3	8.4	262.6	230.5	71.4	126.2	25.0
Barley	72.3	56.2	91.3	40.2	[2]−.4	9.1	[2]−7.2
Oats	24.1	[2]−3.4	17.3	16.0	[2]−18.0	[2]−2.5	5.1
Cotton	952.0	905.2	244.8	348.5	640.7	[2]−386.6	[2]−64.6
Peanuts	8.3	16.7	3.3	20.2	7.1	12.6	[2]−1.8
Tobacco	193.7	174.1	76.4	85.5	36.0	43.1	57.7
Dairy products [3]	33.5	40.4	78.3	[2]−10.1	13.0	9.3	112.7
Total [4]	2,167.9	1,742.0	1,410.5	1,669.2	1,250.3	398.1	[2]−315.0

[1] Diverted quantities times seasonal average price.

[2] Domestic dispositions exceeded acquisitions during year.

[3] Milk equivalent of net USDA acquisitions times manufacturing milk prices.

[4] Totals may not add due to rounding.

Sources (of quantities): *Moving Agricultural Abundance into Consumption,* Foreign Agr. Serv., July 1962; *Reports of Financial Condition and Operation of Commodity Credit Corporation,* Agr. Stabil. and Conserv. Serv.; *1963 Agricultural Outlook Chartbook,* Econ. Res. Serv., November 1962; *Dairy Situation,* Econ. Res. Serv., April 1963.

could not be harvested or grazed unless specifically authorized by the Secretary of Agriculture as a drought relief measure or under conditions of extreme market shortage.

The 1961 Emergency Feed Grain program was an effort to reduce the production of feed grains by reducing the planted acreages of corn and grain sorghum. Participation in this program is estimated to have removed the production of 19.1 million acres of corn and 6.1 million acres of grain sorghum (*15*).

In the absence of detailed estimates of removals by the Conservation Reserve program for 1961, quantity estimates for 1960 were used. Contracts in 1961 were about 0.1 million acres less, but the general yield level for 1961 was higher than in 1960. Also, 1960 average yields of corn and grain sorghum were used in estimating diversions under the 1961 Feed Grain program.

The probable production of major crops on acreages diverted under these programs is an additional component of the excess productive capacity in agriculture. The estimated values of these diversions (USDA estimates of production diverted under the programs times average price) are shown in table 2. Diversions totaled less than $0.3 billion in crop year 1956, but increased sharply, with an expanded program, to $1.2 and $1.6 billion respectively in crop years 1957 and 1958. In crop years 1959 and 1960, diversions again were low but increased to $1.8 billion in 1961 due to the Emergency Feed Grain program. The commodities under the Conservation Reserve program considered in this study only comprised between 63 and 78 percent of CR *acreage* diversions. However, a sizable portion of the remainder of acres diverted was land normally devoted to hay and rotation pasture or summer fallow, idle land, and failure, so that other *crops* not considered represented only 13 to 21 percent of acres diverted under the CR. Estimates of diversions for the Acreage Reserve and Feed Grain programs include all crops coming under these programs, thus representing 100 percent of diversions for these programs.

Subsidized Exports

Our analysis is an attempt to measure the total removals of surplus commodities from commercial markets rather than to compare the relative importance of storage, land withdrawal, and export programs; hence, exports from CCC stocks are not considered separately. Instead, these quantities are included in removals by the CCC storage program with estimates of subsidized export removals limited to quantities from commercial stocks.

The normal commercial demand for exports depends on world prices and economic conditions,

Table 2.—*Estimated value of diversions by Soil Bank and 1961 Feed Grain program, nine major crops, 1956–62*

Crop	Crop year					
	1956–57	1957–58	1958–59	1959–60	1960–61	1961–62
	Million dollars	*Million dollars*	*Million dollars*	*Million dollars*	*Million dollars*	*Million dollars*
Wheat	55.2	355.9	236.0	81.2	132.9	139.8
Rice	2.2	30.7	28.2	.8	1.0	1.0
Corn	144.5	401.7	616.8	154.0	203.9	1,083.2
Grain sorghum	---------	52.3	84.2	18.9	121.5	350.1
Barley	---------	8.7	16.1	28.1	39.1	45.6
Oats	---------	22.8	41.5	70.1	91.1	97.5
Cotton	37.8	292.6	501.8	61.7	75.9	73.5
Peanuts	5.7	2.8	6.1	10.2	14.7	16.1
Tobacco	13.4	53.2	85.4	10.0	11.2	11.7
Total [1]	258.7	1,221.0	1,616.3	435.0	691.5	1,818.5

[1] Totals may not add due to rounding.

Sources (of quantities): *Economic Effects of Acreage Control Programs in the 1950's*, Agr. Econ. Rpt. 18 (*4*); *Conservation Reserve Program of the Soil Bank—1960 Statistical Summary*, Agr. Stabil. and Conserv. Serv.; *Feed Situation*, Econ. Res. Serv., November 1962.

and on the production of agricultural products in foreign countries. Support prices, export subsidies, and other factors complicate considerably the separation of subsidized exports from exports that would have moved without subsidies. For this reason, several alternative estimates were made for Government-supported exports.

Since it was desired to determine total removals (diversions) for the major commodities, the procedure followed was to determine the quantities (from commercial stocks) that were exported with subsidies but would not otherwise have entered the export market. It was arbitrarily judged that exports under the payment-in-kind (PIK) program were in this category. This is an approximation of the upper limit of exports that might be considered as part of surplus production. Other assumptions have also been made which flow from the idea that part or all of Government exports reflected overall policy objectives that removed them from consideration as surplus production.

The PIK program covers exports made from commercial stocks under the Commodity Export program (CEP), Title I of P.L. 480, and the International Wheat Agreement (IWA). Title I sales for foreign currencies are made pursuant to formal government-to-government agreements with friendly countries. Actual sales are made from commercial stocks through private U.S. exporters (*16*), and are assumed to be over and above normal exports (*14*). For example, the USDA states that Title I cotton exports "have been largely net additions to quantities moving otherwise in world trade" (*11*). Under the CEP and IWA programs, CCC subsidizes the difference between U.S. and world prices of export commodities by issuing certificates redeemable in CCC stocks (restricted use, generally) to commercial exporters.

Table 3 shows the values of commodities receiving PIK payments by years and indicates the date of initiation of the program for each commodity. The table includes all nonprocessed commodities eligible for payment in kind. Subsidized wheat exports were $0.4 billion in fiscal year 1957 and increased to $0.8 billion in 1958. Subsidies were nominal for other commodities until 1958–59, when the dollar volume totaled $1.1 billion. The volume continued to expand and the 1960–61 value of subsidized exports was estimated to be $2.2 billion. The 1962 value is slightly reduced from the 1961 level.

Estimates based on alternative assumptions of the role of exports as a part of excess capacity are presented in the following section.

Aggregate Excess Capacity

Summing the foregoing categories of commodities diverted by Government programs, total "excess capacity" is illustrated in table 4. An upward trend in total diversions is apparent until diversions reached a peak of $4.4 billion in 1958–59. (Data before 1955 are not included, but Government removals were less in those years.) After

TABLE 3.—*Estimated value of exports from commercial stocks receiving PIK payments and beginning dates of programs by crops, eight major crops, fiscal years, 1957–62*

Crop	PIK began	Fiscal year					
		1956–57	1957–58	1958–59	1959–60	1960–61	1961–62
		Million dollars	*Million dollars*	*Million dollars*	*Million dollars*	*Million dollars*	*Million dollars*
Wheat	Sept. 4, 1956	382.2	785.2	644.0	676.4	877.3	980.7
Rice	Dec. 15, 1958	----------	----------	20.6	62.0	85.1	101.9
Rye	July 1, 1958	----------	----------	4.8	5.3	5.1	1.1
Corn	May 12, 1958	----------	(1)	167.4	175.4	128.2	15.6
Grain sorghum	July 1, 1958	----------	----------	53.8	71.6	57.5	54.9
Barley	do	----------	----------	79.2	66.2	40.2	28.4
Oats	do	----------	----------	15.4	21.0	6.3	1.2
Cotton	May 29, 1958	----------	(1)	112.4	969.5	1,000.0	706.0
Total	----------	382.2	785.2	1,097.6	2,047.4	2,199.7	1,889.8

[1] Included in 1959 value.

Sources (of quantities): *Report of Financial Condition and Operation of the Commodity Credit Corporation* (June 1961–62), Agr. Stabil. and Conserv. Serv.; *Annual Report by the Secretary of Agriculture* (December 1962); *Feed Situation* (February 1963) and *Wheat Situation* (February 1963), Econ. Res. Serv.

TABLE 4.—*Government diversions, farm output, and adjustment gap in agriculture, 1955–62*

Year	Government diversions				Farm output [1]	Adjustment gap
	CCC	Land withdrawals	Subsidized exports	Total		
	Million dollars	*Million dollars*	*Million dollars*	*Million dollars*	*Million dollars*	*Percent*
1955–56	2,167.9	----------	----------	2,167.9	26,845.3	8.1
1956–57	1,742.0	258.7	382.2	2,382.9	26,894.3	8.9
1957–58	1,410.5	1,221.0	785.2	3,416.7	27,882.3	12.3
1958–59	1,669.2	1,616.3	1,097.6	4,383.1	32,439.3	13.5
1959–60	1,250.3	435.0	2,047.4	3,732.7	30,191.7	12.4
1960–61	398.1	691.5	2,199.7	3,289.3	30,959.1	10.6
1961–62	−315.0	1,818.5	1,889.8	3,393.3	32,643.0	10.4

[1] Net farm output in 1957–59 dollars deflated by the index of prices received by farmers (1957–59=100). Farm output figures are from worksheets of Costs, Income, and Efficiency Branch, ERS.

To farm output estimates from the Costs, Income, and Efficiency Branch, we add the value of output removed by acreage diversion programs. This measure is intended to reflect more accurately "total capacity" of agriculture.

1958–59, the total value of commodities diverted by Government programs remained stable, ranging from $3.7 to $3.3 billion. While there is no apparent tendency for the excess production (diversions) to increase after 1958–59, the future trend will depend on (a) what the public considers to be "socially acceptable prices" for farmers,[4] (b) rates of growth in foreign and domestic population and income, (c) farm productivity and weather, and (d) the institutional and market structure, including the existence of farm organizations designed to restrict marketings and maintain prices.

The trend in total diversions is more stable than trends in the CCC, land withdrawal, and export components. Prior to 1957, emphasis was placed on storage of excess production. Land withdrawal gained importance in 1957 and 1958, but declined in favor of export programs in 1959 and 1960. In 1961, export programs remained at a high level and, combined with a renewed emphasis on land diversions, made possible net sales from CCC stocks.

Overcapacity, measured as the percentage of output diverted from commercial market channels

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[4] Shifts in voting power from farmers to nonfarm population and results of votes on farm programs submitted to farmers can be expected to affect this definition. If "socially acceptable prices" are lowered, ceteris paribus, the necessary diversions from a given output would be reduced and the excess capacity would be smaller.

TABLE 5.—*Alternative estimates of the adjustment gap, 1955–62*

Year	(1) Exports from CCC stocks [1]	(2) Exports from commercial stocks receiving PIK	Total diversions [2]		Farm output [3]	Adjustment gap [2]	
			A	B		A	B
	Million dollars	*Million dollars*	*Million dollars*	*Million dollars*	*Million dollars*	*Percent*	*Percent*
1955–56	1, 160. 4	----------	1, 703. 7	1, 007. 5	26, 845. 3	6. 4	3. 8
1956–57	2, 014. 1	382. 2	1, 424. 4	−13. 4	26, 894. 3	5. 3	. 0
1957–58	1, 406. 9	785. 2	2, 540. 0	1, 224. 6	27, 882. 3	9. 1	4. 4
1958–59	777. 6	1, 097. 6	3, 633. 0	2, 507. 9	32, 439. 3	11. 2	7. 7
1959–60	392. 6	2, 047. 4	2, 756. 7	1, 292. 7	30, 191. 7	9. 1	4. 3
1960–61	547. 4	2, 199. 7	2, 190. 5	543. 2	30, 959. 1	7. 1	1. 8
1961–62	590. 8	1, 889. 8	2, 401. 1	912. 7	32, 643. 0	7. 4	2. 8

[1] 11 commodities. Quantities weighted by seasonal average prices.

[2] Total diversions from table 4 except: Column A excludes 40 percent of columns (1) and (2); column B excludes 100 percent of columns (1) and (2).

[3] See footnote 1, table 4.

by the Government, was 8.1 percent in 1955–56 and reached a peak of 13.5 percent in 1958–59. Since 1958, the excess capacity in agriculture has decreased slightly but still remains above 10 percent. Much the same pattern pertains for other assumptions relating to the treatment accorded exports, but at a lower level. For 1961–62, the excess capacity is lowered to roughly 7 percent under the assumption that part of the export surplus should not be so designated, and to less than 3 percent if all exports are treated that way.

The assumption underlying the estimates of overcapacity in table 4 was that all Government exports and subsidized commercial exports were a component of surplus production. Other "policy objectives" or rationalizations advanced are that such exports return a value to the United States in terms of building subsequent dollar markets for U.S. products, improving nutrition, fostering international goodwill for the United States, and promoting internal political stability in developing countries (*17*). The divergencies of these objectives and inability to quantify the "value return" preclude estimation of a "single" aggregate excess capacity.

Between the extremes of the above assumption and the idea that "full value" is received lies the "true" excess capacity, but only an arbitrary estimate is possible. Schultz has estimated that the value of P.L. 480 products to the countries receiving them has been about 37 cents for each dollar of CCC costs (*7*). We arbitrarily subtract 40 percent of the value of CCC and subsidized commercial exports from total diversions as calculated in the first estimate (table 4) to arrive at a second estimate (A, table 5) of excess capacity. A third estimate (B, table 5) is based on the assumption that these exports receive full value through welfare and defense benefits, and through gains to the United States from use of earned foreign currency—thus they do not represent any excess capacity.

The last two estimates depict the same general trend as the first estimate, with the peak excess appearing in 1958–59. The lack of a uniform increase to 1958–59 and the lack of a uniform decrease since that time are probably due to drawing from CCC stocks of previous years.

The minimum estimate (B) ranges from a slight deficit (essentially a gap of zero) in 1956–57 to an excess of 7.7 percent in 1958–59. The intermediate and perhaps most reasonable estimate (A) of the adjustment gap shows an excess ranging from 5.3 percent in 1956–57 to over 11 percent in 1958–59. The gap by this estimate has remained at slightly over 7 percent for the past 2 years.

Excess Production by Commodities

Estimates of excess production by individual commodities (wheat, feed grains, and cotton) were also based on the assumptions of the intermediate estimate (A) discussed above. Since productive resources are transferable between enterprises, the estimates should not be construed as strictly indicative of needed adjustments that would eliminate the surplus capacity in agriculture. If the excess wheat production were eliminated, resources would

TABLE 6.—*Excess production of wheat, feed grains, and cotton, 1955–62*

Commodity	Fiscal year						
	1955–56	1956–57	1957–58	1958–59	1959–60	1960–61	1961–62
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
Wheat	14. 5	16. 1	45. 0	46. 3	34. 4	37. 8	28. 5
Feed grains	6. 0	7. 8	20. 3	21. 5	11. 5	14. 2	15. 3
Cotton	38. 9	23. 5	11. 8	33. 1	56. 0	12. 4	19. 7

be diverted to creation of greater feed grain overcapacity. Possibilities for adjustments lie not in individual commodities but in the basic factors of production.

In the estimates by crops shown in table 6, feed grain quantities are weighted by seasonal average prices and combined for presentation. Wheat and feed grain estimates reflect the same general trend as the aggregate measure, but diversions of cotton, as a percentage of production plus land diversions, are quite erratic. The wheat and cotton excess has been generally greater than the excess of feed grains. The surplus wheat output was nearly one-half of total production in 1957–59 and about one-third of production in 1959–62. In crop year 1961–62, excess wheat output (28.5 percent) was greater than the excess of either cotton (19.7 percent) or feed grains (15.3 percent).

Adjustment Gap at Various Prices

To determine what prices might have been without the diversion programs, a measure of the aggregate price elasticity of demand is needed. Brandow has estimated the farm-level price elasticity of demand for all farm products used for domestic food to be —0.23 (*2*). While the estimates of excess capacity included nonfood items (cotton and tobacco) and excluded livestock products other than dairy products, they are expected to be closely representative of the aggregate excess for all farm commodities. We assume that the aggregate price elasticity of demand for all excess farm products does not differ markedly from the above estimate.

Given the aggregate elasticity of demand for farm products, what would the adjustment gap have been at various prices? An elasticity of —0.23 implies that, over a particular range of prices and quantities, a 1 percent decrease in the output of farm products results in an increase in farm price of roughly 4 percent. Or, a 4 percent decrease in farm price would be necessary to increase consumption by about 1 percent. Thus, for an adjustment gap of 5.3 percent to be reduced to zero, a reduction in farm price of about 23 percent would be required. Since the intermediate estimate (A, table 5) of excess capacity is considered to be the most realistic, it is the only one considered for further analysis. Estimates of the adjustment gap at various prices, using the index of prices received by farmers and the elasticity estimate of —0.23, are shown in table 7. A column showing the estimated excess adjusted to the mean index of prices received for the period is included to correct for changes in the definition of "socially acceptable prices." This had the effect of reducing the peak excess from 11.2 to 10.1 percent, though changes were smaller or nonexistent in the other years.

TABLE 7.—*The adjustment gap at various price levels, 1955–62*

Year	Index of prices received (1910–14 =100)	Adjustment gap at specified price levels			
		Current	.90 current	.80 current	Mean [1]
		Percent	*Percent*	*Percent*	*Percent*
1955–56	232	6. 4	4. 1	1. 7	7. 0
1956–57	230	5. 3	3. 0	. 6	6. 1
1957–58	235	9. 1	6. 8	4. 4	9. 4
1958–59	250	11. 2	8. 9	6. 5	10. 1
1959–60	240	9. 1	6. 8	4. 4	8. 9
1960–61	238	7. 1	4. 8	2. 4	7. 1
1961–62	240	7. 4	5. 1	2. 7	7. 2
Mean	238	-------	-------	-------	-------

[1] The adjustment gap adjusted to the same price level (the 1955–62 average of prices received by farmers) for each year, hence corrected for year-to-year changes in "socially acceptable prices."

Estimates of the respective magnitudes of the adjustment gap for prices at 90 and 80 percent of the actual level indicate a reduction of the maximums to 8.9 and 6.5 percent, and of the minimums to 3.0 and 0.6 percent. These findings suggest that prices would have had to fall more than 20 percent for farm output to clear the market in the absence of commodity diversions by the Government.

Summary

As noted in preceding sections, estimates in some cases may represent less than total quantities diverted by Government programs. Considering, however, the likelihood of overestimation of values of diversions by CCC and the Acreage and Conservation Reserves due to price weighting, coupled with underestimation of quantities due to failure to include some crops, the percentage of total diversions represented by these estimates is probably well over 90.

The logic of defining net CCC removals as surplus seems appropriate. Implicit in the definition as applied here is the assumption that all fiscal year net acquisitions are from production of the previous (included) crop year. Diversions under land withdrawal programs are calculated from USDA estimates. Estimates of what farmers "would have done" are subject to considerable error, and though estimated yields have been adjusted for quality and location of land contracted, many consider them to be high. The use of average prices received by farmers as weights for CCC acquisitions may impart some upward bias to this estimate, but the only alternative was an arbitrary deflation.

The results indicate that, during the period considered, the adjustment gap rose from 5.3 percent in 1956–57 to a maximum in 1958–59 of 11.2 percent of probable farm output in the absence of the diversionary programs. Since the peak in 1958–59 the gap has decreased slightly, but it remains above the gap existing at the beginning of the period. No basis is apparent for a departure away from the generally stable 1959–62 level of an excess capacity of 7 percent.

Estimates such as the foregoing are somewhat arbitrary due to the absence of a general agreement on what constitutes a "surplus," a condition also reflected in an insufficiency of pertinent data. We believe that this lack of refinement need not detract from the value of this investigation, but we caution that magnitudes defined in this paper may have to be redefined with changing concepts of "fair" or "reasonable" prices.

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Book Reviews

Farmers in Business—Studies in Cooperative Enterprise.

By Joseph G. Knapp. American Institute of Cooperation. 456 pages. 1963. $5.

THIS VOLUME could be appropriately titled "One Man's Views on Agricultural Cooperatives." The man, Joseph G. Knapp, is Administrator of Farmer Cooperative Service, and his views are well worth your attention. Joe Knapp is an articulate and prolific spokesman for cooperatives, as a result of his experience as educator, researcher, and administrator.

The book is essentially an anthology of Knapp's writings and talks to a wide variety of audiences. Most of the selections are from the late fifties and early sixties. The book contains 54 articles ranging in length from 1 to 23 pages. The articles are organized into the following main headings: The Nature of Cooperative Enterprise, Organization and Operation, Lessons From Experience, Challenges and Problems, and The Road Ahead.

"The aim is to present a well-rounded picture of cooperative enterprise in American agriculture rather than a tightly organized compendium that could serve as a textbook." The author thinks of it as a source for browsing or as a book that can be turned to for ideas on specific phases of cooperation or for stimulation. He recognizes that there may be some duplication. Actually, there is surprisingly little duplication.

Knapp has a wholly sympathetic view of cooperatives, but not an uncritical one. A dominant theme that caught my attention is that a cooperative can be no better than the quality of its management.

The book should appeal to a wide range of readership—businessmen both inside and outside the cooperative family, as well as those who may be interested more in the sociology of cooperation. To Joe Knapp cooperatives are more than just a business enterprise. See, for example, his writings on such subjects as "Pride—A Cooperative Ingredient," "The Cooperative Complex," "The Right to Know," and "A Creed for Cooperative Members."

The 11 articles in the final section, The Road Ahead, focus appropriately on the future role of cooperatives in a changing economy. An increasing coordination of economic activities in both national and international affairs seems inevitable. How will this greater coordination be achieved? Cooperatives can assume a more and more significant role the world over. As Knapp sums it up in the final article—it's up to the cooperatives.

Kenneth E. Ogren

Contract Farming, U.S.A.

By Ewell Paul Roy. The Interstate Printers and Publishers, Inc., Danville, Ill. 572 pages. 1963. $8.25.

MANY otherwise well-informed students of agriculture are often astonished at the many kinds of agreements under which livestock and crops are produced and marketed. This book by Ewell Roy runs the agricultural gamut of contractual and integration arrangements—from broilers to hops—from the much publicized to the less well known. One of the stated objectives is to bring "together into one source all the available materials for a unified, logical presentation of this subject, free of emotion and personal bias."

Dr. Roy's book achieves an important place in coordination literature as a descriptive reference source. For each commodity, the author delves into the complex organizational structure of the industry, shows how the various segments are coordinated, and describes the arrangements that nonfarm businesses make with farmers concerning financing, supplies, management, production hazards, and markets. A list of references at the end of each chapter will be of much use to students in this field.

Roy takes an objective view of whether contracting and vertical integration are good or bad for agriculture. He points out the economic reasons for structural change and shows why different forms of vertical coordination have occurred with different commodities and have changed from time to time. Contracts between farm and nonfarm businesses have led to lower prices in some instances as efficiencies have occurred and output expanded. But readers of this book will quickly appreciate how deeply contracts are imbedded in our ways of doing business and how difficult and how undesirable it might be to legislate some of the curbs that have been suggested.

Roy recognizes that there is much that can be done to improve contracts and make them more equitable. This, however, rests largely in the bargaining process between individual producers and contractors. He presents guides to help farmers estimate costs and returns and to otherwise determine the advantages and disadvantages of independent or of contract production. Typical contracts and suggestions for improvement are included.

Several parts of the book are devoted to farmer cooperatives as farm business organizations. These associations provide a way by which farmers can jointly integrate into a supply or marketing business. Also, as separate entities, they may contract with their members. Roy, who has a special interest in cooperatives, indicates some of the inherent dangers for them in contract production. Some cooperatives have had outstanding success with contracting while others have avoided it or experimented with it on a limited scale.

Most controversial are those conclusions that relate contracting and vertical integration to governmental policy. For example, "one must conclude that it was the Federal agricultural price support policies which directly or indirectly led to contract farming on a large scale in the South." Also, Roy indicates that the Feed-Grain Program of 1961 forced canneries in the Midwest to integrate into vegetable and sweet corn production on their own because growers with whom they normally contracted put their acreage into soybeans or kept it idle. Further, Roy says there is very little contracting in such crops as corn, wheat, rice, and cotton because the Federal Government is already contracting by virtue of its acreage controls and price support activities. This, and his statement that with no Government controls "contract farming would no doubt spread rapidly in all commodities," are open to question. Nevertheless, Roy's point of view provides ground for interesting speculation in an area that deserves more thought and research.

This volume presents a wealth of information in simple, readable language. The author makes good use of charts and diagrams and the text is lightened with nearly 150 photographs. *Contract Farming, U.S.A.*, will be a worthwhile addition to the bookshelves of economists, college students, farmers, and others concerned with the welfare of the farming business.

Lawrence A. Jones

The Sources of Economic Growth in the United States and the Alternatives Before Us.

By Edward F. Denison. A Supplementary Paper published by Committee for Economic Development. 308 pages. January 1962. $4.

IN RECENT YEARS the literature on economic growth has been expanding by leaps and bounds. This contribution by Denison would have to be placed on the quality "top shelf" of this literature. The work is an example of a thorough investigation which has resulted in a concise report, remarkable in its consideration of the problems and in its analysis of the factors contributing to economic growth.

Part I of the book deals with the background and plan of the study. In Part II, Denison examines labor, land, and capital as factors in growth and arrives at some evaluation as to the contribution of the many elements that make up these factors. Part III examines the advance of productivity, measuring the contributions of the various forces that affect productivity. Part IV of the work evaluates a "menu of choices" which might be considered to increase the rate of growth.

Denison's basic premise is that economic growth, if it is to be accelerated, must deal with several of many measures. He demonstrates how total national growth can be influenced only slightly by various lines of action or combinations of action. For agriculturists, the message should be clear—agricultural policies, negative or positive, have little to contribute to overall national growth. For example, adding one and one-half years to the time that will be spent in school by everyone completing school between now and 1980, would be three times more important for national growth than shifting to other uses the resources that are going into "unwanted or little wanted farm products." Further application of Denison's method and refinements of it should be applied in regions and areas to see what factors appear to be the overriding ones for growth at these levels. It might be that the position of agriculture (vis-a-vis allocation of resources) in the growth picture is more important in some regions than in others.

Students, administrators, and policymakers interested in economic development will find this book an indispensable reference, not for shelving but for study.

John H. Southern

Land Use Policy and Problems in the United States.

Edited by Howard Ottoson. The University of Nebraska Press, Lincoln. 470 pages. 1963. $6.

IN JUNE 1962 a symposium was held at the University of Nebraska to honor the one-hundredth anniversary of the signing of the Homestead Act by President Lincoln. The symposium did not confine its attention to a history of homesteading but was concerned with reviewing all United States land policy during the past 180 years, appraising significant land problems of the present and future, and exploring implications of the United States experience for land policy in other parts of the world. Sponsored by a number of State and Federal agencies and private foundations, the symposium brought together a significant portion of the Nation's intellectual capital in this subject matter area.

Papers presented at the symposium are published in this volume. The authors include economists, historians, a political scientist, a geographer, a Congressman (Hon. Wayne N. Aspinall of Colorado), and a novelist (Miss Mari Sandoz, author of "Old Jules"). In general, the result is highly satisfactory. There is a minimum of the unevenness, duplication, and raw contradiction found in many symposia.

The book is divided into five sections: (1) the historical background; (2) social factors influencing land policy; (3) past, present, and future demands for land; (4) control of land resources; and (5) future land policy.

The first sections cover the historical development of our land policy, the disposal of the public domain, and the philosophical controversies of an earlier day and their relevance now. John Brewster concludes that "considered as a business in which the operating family is a risk-taking manager of an undertaking in which it does most of the work, the family farm is no less a dominant institution of American agriculture now than it was in Jefferson's day" (p. 130).

W. B. Back, after pointing out the range in size and the diversity in tenure arrangements that characterize present-day agriculture, states that he considers "the family farm in the traditional sense to be a myth, and the family farm by any new definitions to be too arbitrary and general for usefulness" (p. 185). Both Back and Brewster recognize that the "family farm" has always been in large measure an ideal—a model, a goal, a part of our folklore. Where they differ is in their evaluation of this ideal as a practical goal of agricultural policy today.

The section on demands for land presents a balance sheet of our land resources from the creation of the country to the present and on to 1980 with chapters on urban and recreational uses of land. Three chapters on the control of land resources cover private interest in private lands, public interest in private lands, and both public and private interests in public land. This section describes the historical evolution of our tenure system, the role of public land policy in economic development, and the management of our public lands. Implications for future land policy are discussed in one chapter on recent developments in Europe, one on policy issues for the United States, and one on the role of land policy in the distribution of income and wealth in developing countries.

The book ends with Congressman Aspinall's description and analysis of how Congress develops land policy. He admonishes land economists, particularly academicians, to present the results of their research and thinking at Congressional hearings so that their knowledge can be brought fully to bear on national land policies.

One general word on works such as this. Reviewers of similar books recently have expressed concern over the growing numbers of anthologies. Loyd Fischer refers to the "recent rash of publications of series of papers presented at symposiums" (Jour. Farm Econ., Vol. 45, No. 4, p. 894). Gene Wunderlich has asked, "What is the probability of one or two dozen specialists simultaneously having something so important to say, and so cogently developed, that nothing can be omitted?" (Indian Jour. Agr. Econ., Vol. XVII, No. 4, p. 57).

This particular symposium planning committee did their job well. Either the individual authors hewed fairly close to their assigned lines or editor Ottoson deftly adjusted the lines to the hewing and gathered up chips falling too far afield. The book can be highly recommended as enjoyable reading for general edification. Although it would have been more useful had it been equipped with an index, the book will be valuable as a reference and as source material for both students and researchers in land economics.

Robert C. Otte

Studies in Process Analysis: Economy Wide Production Capabilities.

By Alan S. Manne and Harry M. Markowitz. John Wiley and Sons, New York. 427 pages. 1963. $14.

THE EDITORS of this volume state that "The phrase 'process analysis' was chosen to identify studies . . . which approach the analysis of industrial capabilities through models reflecting the structure of productive processes. Process analysis treats industrial capacity, petroleum product specifications, and metal machine operators . . . in contrast to approaches which treat capabilities in terms such as gross national product or interindustry sales and purchases." The models presented are mainly of the activity analysis type involving the simple method of linear programming. Simulation techniques and integer programming play a small role in this book. However, these techniques may receive increased attention in future process analyses studies.

The book is organized into four main industry or topical sections. These are (1) petroleum and chemicals, (2) food and agriculture, (3) metal and metalworking, and (4) programming of economic development. Among the problems considered in the analyses of these industries are output maximization subject to capacity and resource restrictions, optimum spatial distribution of products, plant location and economies of scale, optimum location of production and the determination of comparative advantage in production, and spatial price equilibrium.

There are two features of this volume that make it a genuine contribution to the area of activity or process analysis. First, it presents actual industry studies including the models, the data, and the results. Second, the esthetic appeal of abstract mathematics is strongly tempered with the fact that a lot of hard work and practical knowledge go into the construction and solution of activity analysis models. As Manne states, "The preceding account should be enough to convince anyone that it is no easy task to construct a process analysis model of a single sector—let alone an entire economy, including spacial and temporal details. The formulation of the problem, the gathering of data, and the numerical analysis are time consuming and expensive. . . . The implementation of such models is not a routine mechanical procedure. Without intimate collaboration between the model builder, the data collector, and the numerical analyst, there is little hope for success. From the very outset, both the model builder and the data gatherer must have some appreciation of the problem involved in the numerical analysis of their material." The authors candidly point out both the strong points of process analysis and its weaknesses.

If there is one weakness in some of the chapters, it is the brief statements concerning the objective functions of the linear programming models. For example, in Manne's chapter on the U.S. petroleum refining industry he states that "the model used here was of the conventional linear programming type. One way to describe this mathematical structure is to refer to the maximization of a linear form, subject to linear inequality restraints." The reader is well into the chapter before he realizes what is being maximized.

I have not singled out any articles for special mention because all of them are commendable pieces of research. The book is a welcome contribution to the literature on applied activity analysis.

Martin E. Abel

Price and Quantity Trends in the Foreign Trade of the United States.

By Robert E. Lipsey. A Study by the National Bureau of Economic Research. Princeton University Press, Princeton, New Jersey. 475 pages. 1963. $10.

A MAJOR GAP in the data on U.S. foreign trade has been filled and a major limitation to analysis of changes in international trade has been removed with the publication of this monumental study by the National Bureau of Economic Research. This study provides a new set of data on the foreign trade of the United States from 1879 to 1923, a period for which previous trade data were not very reliable. Analysis of changes in the commodity composition of trade can now be made as the changes in price and quantities can be separated. The inability to make this separation has long been a major bottleneck in studies of trends and cycles in American international trade and finance.

With the presentation of these new data on trade the validity of at least three widely held views is seriously challenged. These are (1) that international trade has declined in importance with economic development, (2) that the terms of trade of developed countries have improved over time, and (3) that the terms of trade of agricultural products have deteriorated greatly over the long run relative to manufactures.

The data presented in this study show that, except for the 1919–40 period, the foreign trade of the United States, like almost every other aspect of its economic life, has been characterized by persistent growth since 1869.

The great depression of the 1930's, which affected most countries, forced a decline in both U.S. and international trade until 1940. Since then, the volume and value of U.S. exports have kept pace with world economic growth and regained the long-term upward trend established at the end of the Civil War.

Foreign markets have played a strategic role in American economic growth. This study shows that exports were most important during the period when American production was growing most rapidly. Therefore, these results contradict the widely held belief that economic development of a country reduces its dependence on foreign trade and that the spread of industrialization throughout the world tends to diminish the importance of international trade. This study also contradicts the belief that there has been a substantial improvement over time in the terms of trade of developed countries and for manufactured products—at least as far as this country is concerned.

Dr. Lipsey has demonstrated many different ways of analyzing trade data, especially graphically, to capture the broad long-run patterns of trade. While the presentations of basic data in terms of ratios and percentages of other ratios are illuminating, they are, to say the least, difficult to follow. The difficulty of following the inverse movements of two ratios is large and requires effort to translate the meaning of the graphs in terms of one factor or item. Aside from this limitation the book is well written.

Actually, only 136 pages are devoted to the presentation of the results, while 339 pages are devoted to the presentation of actual and estimated trade data in tabular form. For this reason, the book will be an excellent reference for most libraries. It will also be useful as a reference for those directly engaged in international trade research. Its use will be primarily limited to teaching and research, although it may prove to be very helpful to officials, both public and private, who are responsible for the development and improvement of research and educational programs.

Arthur B. Mackie

The Economic Development of Kenya.

International Bank for Reconstruction and Development. Johns Hopkins Press. 380 pages. 1963. $8.50.

UHURU—independence—came to Kenya on December 12, 1963, at a time when the political cauldron was simmering. This study, an exploratory analysis of the economy of Kenya, comes at a crucial and transitional time of important political, economic, and social changes for Kenya. The IBRD Mission study is perhaps the most current and comprehensive analysis of the economy of Kenya that has been published thus far. It calls attention to the prevailing and pressing economic problems that independence brings to developing countries of Africa, and the dependence of these countries upon certain agricultural exports.

A team of 10 specialists prepared the study for the IBRD at the request of Kenya and the United Kingdom. Their main objectives were to review the economic potential of Kenya and to make recommendations designed to assist the government of Kenya in developing plans up to 1967 which will stimulate Kenya's economy and raise the standard of living of the people.

This report deserves the attention of students and African specialists for its thoroughness, its many maps and tables closely related to the text, and its direct approach to Kenya's current development problems. Throughout the study the interplay of the economic, political, and social factors and their relationship to Kenya's economic development are stressed. The recommendations are based on assumptions which are adequately presented, but ways to carry out the recommendations are not indicated.

While there is scope for expansion of industrial activities and tourism, Kenya's economy is essentially agricultural. Strong support is given by the

Mission to a continuation of the Swynnerton Plan which, since its inception in the mid-1950's, has encouraged the reorganization and modernization of agriculture in Kenya. The report states that the effects of the Swynnerton Plan are "unique in the history of development of underdeveloped countries. What has been achieved . . . stands as a model for future development, not only in relation to Kenya, but to many other underdeveloped countries of the world."

The need for government assistance to agriculture in the form of credit, extension services, research, and marketing activities is given great emphasis. This study also reviews and evaluates government policies in regard to mining and manufacturing, hydroelectric power, transportation, tourism, money and banking, public finance, and social services. The importance of education, communications, and transportation is stressed.

Emphasis is placed on maintaining an adequate supply of experienced administrators, technicians, and professional men to bring about continued growth in Kenya's economy. The role of the government in restoring and maintaining the confidence of private investors is described. The 10 specialists urge the wise use and allocation of the scarce resources available to the Kenya government, as well as policies that will assist in attracting development funds, foreign investment, and technical assistance from abroad. It is to be hoped that these guidelines to economic development and policy that have been formulated by the survey team will not go unheeded, but will be put into action.

Carey B. Singleton, Jr.

The Rise of the Dairy Industry in Wisconsin: A Study in Agricultural Change, 1820–1920.

By Eric E. Lampard. 466 p. Madison, State Historical Society of Wisconsin. 1963. $6.

TODAY, dairy products are America's second most important source of farm income. In several States, including Maryland, Michigan, Ohio, Pennsylvania, New York, Wisconsin, and the New England States, except Maine, dairy products are the most important source. They were not always so.

Eric E. Lampard, using a felicitous combination of economic theory and historical framework, tells how and why this change took place. The volume won its author, a professor at the University of Wisconsin, the Dale Clark Everest prize in Wisconsin economic history.

The author traces the dairy industry not as an isolated factor in the development of Wisconsin, but as one major factor in a series of economic and technological changes. Thus the first three chapters of the book summarize the settlement of the State, its general agricultural history to about 1880, and the beginnings of specialization in dairy farming. In subsequent sections, the author traces the revolution in dairying and the marketing of dairy products.

The industrial revolution in dairying was marked by increasing specialization and the movement of the manufacture of dairy products from the farm to the factory. The dairy farmer concentrated on improving feeds and breeds in order to increase the flow of milk at lower unit costs. The silo, introduced into the Midwest in the 1870's, permitted better year-round feeding of dairy stock, while research at the University of Wisconsin brought the newly developing sciences of nutrition, chemistry, and animal husbandry to bear on the problems. The "associated dairy system" provided the organizational form for local cheese factories, while the railroads and refrigerator cars opened new markets. The State dairymen's association led in some of the vital marketing developments, and pioneered connections with profitable dairy markets at home and abroad.

Exports of cheese increased rapidly in the 1880's, but declined even more rapidly in the 1890's. Enough producers had shipped skim and filled cheese to their foreign customers to give all American cheese a bad name. This temporary decline in demand for cheese stimulated butter making. From 1889, when Wisconsin appointed its first dairy commissioner, leaders in the dairy industry called upon the State to control the adulteration of dairy products. In spite of short-run fluctuations, the dairy industry has been a major force in the economic development of Wisconsin.

This volume, a definitive study of the development of Wisconsin's dairy industry to 1920, is recommended to the dairy economist, specialists in agricultural marketing, cooperative leaders, those interested in case studies of economic growth, and economic historians. This study has important implications for future agricultural development here and abroad.

Wayne D. Rasmussen

Selected Recent Research Publications in Agricultural Economics Issued by the U.S. Department of Agriculture and Cooperatively by the State Universities and Colleges[1]

BANKS, VERA J., CALVIN L. BEALE, and GLADYS K. BOWLES. FARM POPULATION ESTIMATES FOR 1910–62. U.S. Dept. Agr., Econ. Res. Serv., ERS–130, 49 pp., illus. October 1963.

The farm population of the United States reached an estimated peak of 32.5 million in 1916, making up about a third of the total population. In 1962, farm people numbered 14.3 million, about one-thirteenth of the total. This bulletin shows all available annual estimates on the size, geographic distribution, net migration, and natural increase of the farm population.

BIRD, ALAN R. LEAST COST ORGANIZATION OF MASSACHUSETTS DAIRY FARMS FOR FOUR LEVELS OF GROSS INCOME. Mass. Agr. Expt. Sta., Amherst, Pub. 539, 29 pp., August 1963. (U.S. Dept. Agr. cooperating.)

The study used the electronic computer at the University of Massachusetts to budget the long-term least-cost organization of Massachusetts dairy farms. For annual levels of milk production of 2,400 cwt., 3,360 cwt., and 3,840 cwt., the estimated respective long-term annual operator earnings are $2,500, $3,500, $4,500, and $5,500. "Operator earnings" are the cash returns to the farmer for his labor and management after deducting annual expenses from gross sales.

BOHALL, ROBERT W., JOSEPH C. PODANY, and RAYMOND O. P. FARRISH. PACKING MATURE GREEN TOMATOES: QUALITY, COSTS, AND MARGINS IN THE LOWER RIO GRANDE VALLEY OF TEXAS. U.S. Dept. Agr., Mktg. Res. Rept. 635, 28 pp., illus. November 1963.

Shipping point margins of tomatoes in the Lower Rio Grande Valley (the difference between the average price paid to growers and the f.o.b. price of all tomatoes sold) reflect rather closely the changes in packing costs caused by changes in quality of tomatoes. Researchers found that, in 1962, in a shed of average efficiency packing costs increased about 0.54 cent per pound when quality decreased from 60 to 40 percent U.S. No. 1 grade. For such a change in quality, the weekly average increase in margins was 0.38 cent per pound, or within 0.16 cent of the change in packing cost.

BURNS, ALFRED J., GEORGE R. ROCKWELL, JR., and ELTON THIGPEN. APPLE MARKETING—A REVIEW OF ECONOMIC RESEARCH, 1945–1960. U.S. Dept. Agr., Econ. Res. Serv., ERS–140, 36 pp. October 1963.

Current research information on three phases of apple marketing—demand-supply relationships, merchandising and promotion, and marketing costs and margins—is summarized, and areas where additional research is needed are suggested. Research publications covered in this digest are included in *A Bibliography of Apple Marketing Research, 1945–60*, U.S. Dept. Agr., Misc. Pub. 866.

CLEMENT, WENDELL E. USE AND PROMOTION OF DAIRY PRODUCTS IN PUBLIC EATING PLACES. U.S. Dept. Agr., Mktg. Res. Rpt. 626, 25 pp. August 1963.

Per capita consumption of dairy products on a milk equivalent basis has declined from 768 pounds in 1947 to 640 pounds in 1962. This bulletin gives the results of a survey of public eating places in and around Hartford, Conn., and Indianapolis, Ind. It indicates that much improvement can be made in the merchandising of dairy products in restaurants.

COOKE, FRED T., JR. THE ECONOMICS OF SUPPLEMENTAL IRRIGATION IN COTTON; YAZOO-MISSISSIPPI DELTA. Miss. Agr. Expt. Sta. Bul. 669, 28 pp. July 1963. (Econ. Res. Serv. cooperating.)

Syphon tube systems are the cheapest method of irrigation for the Mississippi Delta. Where this method of irrigation is not possible, skip row planting could prove to be more profitable than irrigation. If this practice becomes more widespread it is doubtful that many more acres of cotton would be irrigated in the future.

COWHIG, JAMES D. AGE-GRADE SCHOOL PROGRESS OF FARM AND NONFARM YOUTH: 1960. U.S. Dept. Agr., Agr. Econ. Rpt. 40, 22 pp. August 1963.

Results of the 1950 and 1960 Censuses are used to compare the school progress of farm and nonfarm children and to describe changes that occurred over the decade. Highlights of the study show that between 1950 and 1960 the proportion of farm children enrolled in school increased substantially. During the same decade improvement took place in the proportion of farm and urban children enrolled in grades expected for their age.

COWHIG, JAMES D. SCHOOL DROPOUT RATES AMONG FARM AND NONFARM YOUTH: 1950 AND 1960. U.S. Dept. Agr., Agr. Econ. Rpt. 42, 30 pp., illus. September 1963.

Information from the 1950 and 1960 Censuses of Population is used to derive estimates of the number and proportion of farm and nonfarm youths who dropped out of school before finishing high school. Between 1950 and 1960 school dropouts among 14-to-24-year-olds declined. Dropout rates are shown by age and residence for the entire United States, and the South separately.

DAY, RICHARD H. SIMPLE METHODS OF ESTIMATING CERTAIN NONLINEAR FUNCTIONS WITH EMPHASIS ON AGRICULTURAL DATA. U.S. Dept. Agr., Agr. Handbook 256, 28 pp., illus. August 1963.

Two elementary methods are presented for fitting three different nonlinear functions to empirical data by means of simple linear regressions. Iterative least squares methods which have been developed for estimating parameters of nonlinear functions sometimes lead to certain difficulties in application. Because this is so, the methods developed in this handbook are useful tools for application.

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[1] State publications may be obtained from the issuing agencies of the respective States.

DONALD, JAMES R., FRANK LOWENSTEIN, and MARTIN S. SIMON. THE DEMAND FOR TEXTILE FIBERS IN THE UNITED STATES U.S. Dept. Agr., Tech. Bul. 1301, 150 pp., illus. November 1963.

This bulletin identifies and measures the effects of the principal economic forces that cause variation in textile fiber consumption in the United States. It develops estimating equations which explain from 87 to 95 percent of the variation in fiber consumption. Fibers covered by the analyses are cotton, apparel wool, carpet wool, and manmade fibers. The first part of the report records trends in consumption and in the trade balance of textile fibers, and discusses the development of new statistical series. The second part is concerned with statistical analyses of the economic factors that affect domestic consumption of textile fibers.

DROGE, JOHN H. ECONOMIC FEASIBILITY OF RADIATION-PASTUERIZING FRESH STRAWBERRIES, PEACHES, TOMATOES, GRAPES, ORANGES, AND GRAPEFRUIT. U.S. Dept. Agr., Econ. Res. Serv. ERS–131, 24 pp. August 1963. (Prepared for U.S. Atomic Energy Commission.)

Fresh produce handlers were asked their opinions of radiation-pastuerizing, which might be used to extend the cold storage life of fresh fruits and vegetables. They thought the process would have two main advantages—it would reduce spoilage losses, and maintain quality. Among the disadvantages they expected is consumer resistance due to fear of the process.

GARLOCK, FRED L., PHILIP T. ALLEN, AND OTHERS. THE BALANCE SHEET OF AGRICULTURE, 1963. U.S. Dept. Agr., Agr. Inf. Bul. 281, 25 pp., illus. September 1963.

This is the 19th in a series of annual estimates since 1940. It shows farm assets and farm debts at the beginning of 1963 and selected earlier years. It deals mainly with changes that occurred during 1962 in the financial situation of agriculture.

GAVETT, EARLE E. TRUCK CROP PRODUCTION PRACTICES, IMPERIAL COUNTY, CALIFORNIA—LABOR, POWER, AND MATERIALS BY OPERATION. U.S. Dept. Agr., Econ. Res. Serv., ERS–128, 42 pp., illus. September 1963.

California leads the Nation in the production of truck crops and Imperial County is the great winter vegetable producing area of the West. Truck crops, in general, require intensive labor. These requirements are highly seasonal with several labor peaks, the highest occurring at harvest. Thinning and weeding are two operations still performed largely by hand labor.

GAVETT, EARLE E. TRUCK CROP PRODUCTION PRACTICES, MONTEREY COUNTY, CALIFORNIA: LABOR, POWER, AND MATERIALS BY OPERATION. U.S. Dept. Agr., Econ. Res. Serv., ERS–129, 41 pp., illus. November 1963.

California leads the Nation in the production of truck crops. Fewer than 6 percent of the State's vegetable farms were located in Monterey County, but they accounted for over 14 percent of the harvested acreage of vegetables. Information in this report was obtained from 121 producers in Monterey County.

GOODWIN, JOHN W., JAMES S. PLAXICO, and WILLIAM F. LAGRONE. AGGREGATION OF NORMATIVE MICROSUPPLY RELATIONSHIPS FOR DRYLAND CROP FARMS IN THE ROLLING PLAINS OF OKLAHOMA AND TEXAS. Okla. Agr. Expt. Sta., Tech. Bul. T–103, 69 pp., illus. August 1963. (Econ. Res. Serv. cooperating.)

Linear programming techniques were employed to estimate normative microsupply relationships for each of 10 units under 30 possible combinations of cotton prices, feed grain and livestock prices, and capital costs. The resulting 300 microsupply estimates are shown in tables and charts.

HECHT, REUBEN W. LABOR USED TO PRODUCE LIVESTOCK; ESTIMATES BY STATES, 1959. U.S. Dept. Agr., Statis. Bul. 336, 21 pp. September 1963.

Contains State estimates of the man-hours of labor used in 1959 for producing the major kinds of livestock. Similar estimates are developed every fifth year after data from the agricultural census are available.

HEPP, RALPH E., SYDNEY D. STANIFORTH, GUSTAF A. PETERSON, AND RUDOLPH A. CHRISTIANSEN. THE ROLE OF FARM AND FINANCIAL MANAGEMENT IN PRODUCTION CREDIT ASSOCIATIONS IN WISCONSIN. Wis. Agr. Expt. Sta., Bul. 565, 12 pp. June 1963. (Econ. Res. Serv. cooperating.)

Farm credit institutions base their loans to farmers on the farmers' repayment ability, managerial ability, and the amount of collateral available. Relative to the size of the loan, lower income farmers pledged more collateral than did higher income farmers. Some loans made to farmers with relatively low incomes involved continuous renewal problems, because farm income was not high enough to retire the debt.

HILL, E. B. FARM RENTAL AGREEMENTS. Coop. Ext. Serv., Mich. State Univ., Ext. Bul. E–378, 28 pp. September 1963. (U.S. Dept. Agr. cooperating.)

Because of changing practices and economic conditions on Michigan farms, the traditional farm rental arrangement frequently needs adjustment to make it more equitable between landlord and tenant. The bulletin describes several types of farm leases and the different situations for which each type is appropriate.

Holder, Shelby H., and Oliver L. McCaskill. costs of electric power and fuel for driers in cotton gins, arkansas and missouri. U.S. Dept. Agr., Econ. Res. Serv., ERS-138, 12 pp. October 1963.

Power is one of the most important variable costs in a ginning operation. This item alone costs the Nation's ginners millions of dollars each year. The purpose of this study was to determine power costs for specified types of gins and the factors affecting these costs, and consumption of fuel for driers and its cost per bale ginned.

Johnson, Robert W. operation of the p.l. 480 program in brazil. U.S. Dept. Agr., Econ. Res. Serv., ERS-Foreign-59, 34 pp., illus. November 1963.

Wheat and flour accounted for 90 percent of P.L. 480 exports to Brazil from July 1955 to June 1962. From July 1945 to December 1961, agricultural commodity assistance under P.L. 480 comprised one-fourth of all U.S. assistance to Brazil. Declining domestic wheat production, prospects for continued shortage of foreign exchange earnings, and other factors will tend to increase reliance on concessional imports of wheat and thus the importance of the P.L. 480 program to Brazil.

Keefer, James F. summary and evaluation of "the philippines: long-term projection of supply of and demand for selected agricultural products (ers-foreign-34)" with implications for u.s. exports. U.S. Dept. Agr., Econ. Res. Serv., ERS-Foreign-58, 40 pp. November 1963.

Substantial growth and shifts are projected for the Philippine economy. The population is projected to increase at an annual rate of over 3 percent and there is to be a shift to the urban areas. The growth and growth rate of the general economy will have an important impact upon import requirements and import capability.

Larsen, Marion R. the agricultural situation and crop prospects in communist china, 1963. U.S. Dept. Agr., Foreign Agr. Econ. Rpt. 10, 16 pp.

Prospects for the 1963 harvest in Mainland China are little if any better than in 1962. Production of summer-harvested grain crops was less than last year's poor harvest. The outlook for intermediate and late rice is only fair, and the output of miscellaneous grains probably will not offset early grain losses.

McElroy, Robert C., and Jules V. Powell. economic aspects of pecan production and marketing: arkansas, florida, georgia, mississippi, new mexico, and south carolina. U.S. Dept. Agr., Agr. Econ. Rpt. 41, 42 pp., illus. September 1963.

Contains production and marketing data obtained from 576 pecan growers who owned 370,000 pecan trees, or 13 percent of the trees listed in the 1959 Census of Agriculture for the six States in the study. The most common cultural practice in pecan orchards was disking. Growers fertilized 78 percent of the survey acreage. Growers reported that 95 percent of their pecans were sold to dealers.

Press, Charles, and Rodger Rice. rural residents and urban expansion. U.S. Dept. Agr., Econ. Res. Serv., ERS-132, 18 pp. September 1963. (Mich. State Univ. cooperating.)

This report deals with the opinions of nonfarm residents concerning urban expansion into farm areas. The study was made in a township lying on the fringe of a growing metropolitan area. An earlier study reported the opinions of farmers in the same area.

Reed, Robert H., and L. L. Sammet. multiple-product processing of california frozen vegetables. Calif. Agr. Expt. Sta., Giannini Found. of Agr. Econ., Giannini Found. Res. Rpt. 264, 203 pp., illus. July 1963. (U.S. Dept. Agr. cooperating.)

Economic and engineering research procedures are used in a synthesis of costs for a series of different plants designed for single-product output of six major frozen vegetables—broccoli, brussels sprouts, green peas, lima beans, snap beans, and spinach. The report is in two sections: (1) Analysis of Operations and Costs, and (2) Labor and Equipment Standards and Requirements for Preparation and Packaging.

Rogers, George B., and Earl H. Rinear. costs and economies of scale in turkey processing plants. U.S. Dept. Agr., Mktg. Res. Rpt. 627, 61 pp., illus. September 1963.

Gains in turkey processing efficiency have occurred in recent years with the adoption of new technology, increases in plant size, and better use of capacity. According to data from 25 plants surveyed, average costs per pound decline when plant size increases. Plant managers can use these data to compare their present situations with similar plants and plan for the future.

Stansberry, Robert R., Jr. the rural fringe and urban expansion; a case study of prince georges and montgomery counties, maryland. U.S. Dept. Agr., Agr. Econ. Rpt. 43, 34 pp. October 1963.

In 1960 suburbanization processes were studied in two Maryland counties adjacent to Washington, D.C. Here are some of the findings: Although 1 fringe family in 10 is living on a farm, more than half the household heads have a rural background. Fringe residents are oriented toward the rural, rather than the urban, side of living. All walks of life are represented among fringe residents: poor and rich, professional workers, and unskilled laborers.

Taves, Marvin J., and Gary D. Hansen. minnesota farmers and social security. Univ. Minn., Agr. Expt. Sta. Bul. 467, 44 pp., illus. June 1963. (Econ. Res. Serv. cooperating.)

Farmers were interviewed in three of Minnesota's five major farming areas. The study was designed to learn what changes respondents may have made since 1954 when farmers were first included under the Social Security Act, and attitudes toward the program of those now paying social security taxes or receiving benefits. Many beneficiaries and nonbeneficiaries reported a desire for more information on social security, and for Government counseling on retirement preparation.

THORFINNSON, T. S., and A. W. EPP. COST OF OPERATING TILLAGE AND HARVESTING MACHINERY IN NEBRASKA. Nebr. Agr. Expt. Sta., Statis. Bul. 475, 22 pp., illus. March 1963. (Econ. Res. Serv. cooperating.)

Selected tillage, planting and harvesting machines were studied to determine the cost of operation and rate of performance for each kind and size. Information on costs for each machine includes purchase price, depreciation, repairs, grease, oil, and fuel. Information on performance includes total acres for which each machine was used and number of hours of use.

TSU, SHELDON. FINANCIAL ASSISTANCE TO AGRICULTURE IN DENMARK. U.S. Dept. Agr., Econ. Res. Serv., ERS–Foreign–63, 10 pp. November 1963.

Farm profits in Denmark have deteriorated in recent years. Agricultural prices have declined considerably, while production costs increased. The report describes government assistance to farmers under the Agricultural Marketing Act of July 9, 1961, the first official agricultural subsidization program in recent Danish history. The Danish Government has attempted to limit increases in assistance to agriculture. However, until the Common Market situation and other related factors are clarified, agricultural assistance in Denmark is likely to continue.

VAN DRESS, MICHAEL G. ESTIMATED NUMBER OF DAYS' SUPPLY OF FOOD AND BEVERAGES IN WAREHOUSES AT WHOLESALE, 1963—A CIVIL DEFENSE STUDY. U.S. Dept. Agr., Econ. Res. Serv., Mktg. Res. Rept. 632, 24 pp., illus. October 1963.

For each person in the United States there is a 16.1-day supply of food and a 4-day supply of beverages in warehouses at the wholesale level of distribution. Canned, bottled, dried, and packaged products, which can be kept for a long time without refrigeration, represent more than 84 percent of total stocks. This study was made by the USDA at the request of the Office of Civil Defense.

YOUMANS, E. GRANT. THE RURAL SCHOOL DROPOUT: A TEN-YEAR FOLLOW-UP STUDY OF EASTERN KENTUCKY YOUTH. Bul. Bur. School Serv., Univ. Ky., Vol. 36, No. 1, 31 pp., illus. September 1963. (Econ. Res. Serv. cooperating.)

In 1950, a total of 757 boys were enrolled in the eighth grade of the public school in 11 eastern Kentucky counties. In 1960, 307 of these youths were interviewed. More than half the respondents had dropped out of school before completing the twelfth grade, and most of these had received only eight years of formal education. The report discusses the work life and community life of the young men who were interviewed.

U.S. DEPARTMENT OF AGRICULTURE. HANDBOOK OF AGRICULTURAL CHARTS. Agr. Handbook 258, 198 pp., illus. September 1963.

Contains information on the overall economic situation, commodities, foreign agricultural trade, marketing, farm population, and family living. The book is intended for use primarily by economists and agricultural businessmen. There are 178 charts, most of them accompanied by tables of detailed data.

U.S. DEPARTMENT OF AGRICULTURE. AGRICULTURAL PROTECTION BY NONTARIFF TRADE BARRIERS. Econ. Res. Serv. and Foreign Agr. Serv., ERS-Foreign-60, 24 pp. September 1963.

The following nontariff controls were studied, for the United States and 17 other countries: Import quotas and embargoes, variable levies and gate price system, conditional imports, monopolies, advance deposits on imports, import discrimination and preferential treatment, import licensing, and bilateral agreements.

U.S. ECONOMIC RESEARCH SERVICE. DEVELOPMENTS IN MARKETING SPREADS FOR AGRICULTURAL PRODUCTS IN 1962. U.S. Dept. Agr., ERS–14 (1963), 32 p., illus. August 1963. (Reprinted from Hearings Before the Subcommittee of the Committee on Appropriations, United States House of Representatives, Eighty-eighth Congress, First Session.)

Shows spread between retail and farm prices of food products, farmer's share of the consumer's food dollar, hourly earnings of food marketing employees, and total profits of major food processing and distributing firms.

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